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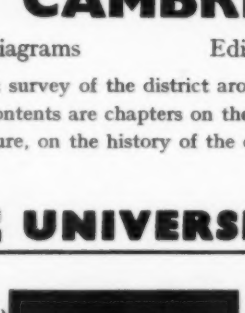

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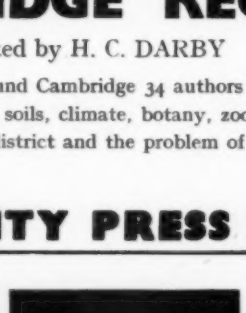

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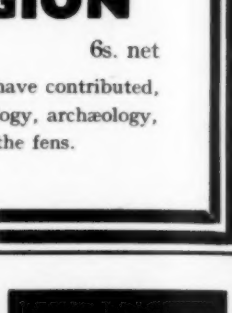

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Concepts of Human Progress

A FORTNIGHT ago, in an article entitled "The Promotion of Peace", we referred to events which claimed the interest of the whole civilized world, and upon the settlement of which depended the lives of millions of people. We were able to record that, as the result of consultations between statesmen, an agreement was reached which, though its justice may be disputed, prevented nations from being thrust wantonly over the precipice into a world-war. Thanks to the facilities of rapid transit and world-wide direct communication, which science has placed at the service of statesman and press, the full weight of the world's judgment was brought to bear as the hour of crisis drew near, until perhaps—who can say?—it turned the scale. Had such rapid and extensive means of making plain the judgment and trend of opinion among peoples been available in 1914, actions which resulted in the Great War might have been averted.

In the first flush of enthusiasm at the recent preservation of peace, it seemed that the crisis through which we had passed had quickened perception of values in the essentials of life, to most of which we had been prepared to bid a long, and perhaps an eternal, farewell. Hope, founded on the promise of the Anglo-German pact, looked forward to the removal of the menace of war to set mankind free for the pursuit without distraction not merely of enjoyment of the advantages which the advancement of scientific knowledge holds out for the future, greater even than the wonders with which it has endowed mankind in the past generation, but also of real and substantial progress, in a healthier atmosphere, in the scientific study and resolution of the problems which lie at the root of world economic and social unrest.

Disillusion has been rapid, complete and painful. The first task to which we are now bidden to turn of necessity and at redoubled speed is armament and provision for defence. So much the more then are energies and resources withdrawn from the advancement of what we had come to realize were the essential needs of future development in human life. The sole palliation is that our aim is the preservation of the freedom of the spirit which alone consorts with the dignity of man.

Let there be no illusions as to the character of the struggle which will be involved in modern warfare. It is a reversion to the methods of savagery. In the scale of development of human society, war has played a useful and, biologically speaking, a necessary part. The society which at a certain stage of development depends upon the prowess of heroes pitted against their like, breeds heroes to ensure qualities essential to its survival in the struggle for existence. But the day of heroes in war is past. Modern war, which will be waged from the air, is the warfare of the primitive head-hunter, in which the raider returns triumphant from his raid after the slaughter indiscriminately of man, woman or child. The principles of warfare are unchanged—"Find the forces of the enemy and destroy them"; but those forces are no longer armed forces; they are the whole people, whose morale must be destroyed. Could any parallel be closer to the head-hunter, who brings back with each head something of the spiritual force of the enemy he has slain?

In the development—evolution in the popular sense—of progressive human societies, the line of advance has been towards ever-increasing aggregations of individuals—from family to tribe and from tribe, through a regular gradation of political

units, to empire. If the warlike qualities have played their part in each of these forms of human association in securing that independence of existence which is essential for internal development, there has been an equal and parallel development of those qualities in the individual, which make for just and harmonious association between the members of a social group—the qualities of justice, of capacity for co-operation, of consideration for others, and care for the weak. It is these qualities which give solidarity to the group, and are no less conducive to its survival, than the warlike qualities which preserve it from aggression from outside.

Such social characters are, however, not only the essentials of internal peace and advancement, but also they react on those higher qualities of the human mind, in the exercise of which man approaches most nearly to exhibition of his specifically human characters, unaffected by cultural divergence. These higher manifestations of his spirit, if in origin based upon a tradition peculiar to his group, nevertheless in their highest development transcend such limitations. Of such are literature, art and scientific knowledge, which when they attain their highest powers, speak a universal language.

At the same time, with each advance in social gradation the system of social and religious ethics is extended to embrace a wider circle, until in certain of their concepts they, too, approach a universal appeal to mankind at large, rather than a restricted cultural group. No one has ever questioned that in these higher manifestations of the spirit, man attains, and will attain, his highest development, whatever may be his advancement in the field of the material. Further, it is a matter of experience, no less than a postulate of reason, that for their full and complete expansion and growth, free intercourse and exchange of experience and thought are essential, without barriers of race or political frontier to exclude any form of intellectual development as alien. While similarly the ethical system, in the long run, whether it be bound to a specific form of religious belief or not, will come to recognize the claims of ethical concepts common to humanity at large, irrespective of creed.

In the intercourse between national groups, which is become an essential condition of the development of the activities of the higher faculties, civilized man has transcended the group to embrace humanity as a whole. As men bend their minds to the problems which arise in this extended outlook, if advancement is to continue it will demand more and more a scientific approach to these problems, which, however much they may depend upon conditions within the group, are world-wide in application or in effect.

In an increasing degree these problems will arise in connexion with the backward, no less than with advanced, peoples. An ever-growing sense of the responsibility of Western civilization to protect 'primitive' races from the more harmful and disintegrating effects of its own impact on their culture and institutions will, by the logic of circumstances, carry conviction that both wisdom and justice demand that this state of tutelage, no longer susceptible of exploitation for national advantage or prestige, should carry with it an obligation to develop in these peoples not only the capacity to deal with the special problems of their own government, but also to co-operate with the white man in the solution of questions of wider import. Events of the last decade, more especially in the economic field, have driven home forcibly the lesson that there are few peoples so remote, so self-sufficient—in short, so primitive—as to escape the repercussions of the major crises at the heart of civilization. Pursuit of the material benefits conferred in the spread of Western civilization has led to the assumption all too readily that ultimately Western ways of thought, Western beliefs will set the world standard. In the reaction which is at hand—nay, which has already begun in Africa and in the East—understanding, tolerance, and breadth of view can alone bring about the adjustment which will avert conflict.

Unfortunately, man's political and economic advancement has lagged behind his intellectual and material progress. The League of Nations, which represented an attempt to attain an aggregation transcending the national group, has accomplished much valuable work in the study of problems in which scientific and intellectual co-operation was possible without regard to national grouping. Nevertheless, it has failed in its main object, because in the international sphere its approach to political problems has been upon a national rather than an international basis. If the Anglo-German pact were, in fact, the first step towards a policy of discussion and conciliation, in which discussion proceeded to each specific problem with a scientific outlook and the aim of human, and not national, advancement and, be it added, without the accompaniment of the rattle of arms, we might indeed look for the approach of an era, of which the League of Nations was but the false dawn.

The Critic Triumphant

Retrospect:
an Autobiography. By T. A. Rickard. Pp. xi+402+5 plates. (New York and London: McGraw-Hill Book Co., Inc., 1937.) 12*s.* 6*d.*

MAINLY, this retrospect is the story of the author's life, the life of a man who successively was mining engineer and editor, retiring then to enter with no less success upon a wider scholarship. Of less sustained interest it includes stories of travel, of contact with American presidents, and of selections from speeches made and addresses given.

Born in the mining tradition and trained in an *alma mater*, the Royal School of Mines, London, of which he remains throughout a loyal son, this life-story is of a man, high-principled and sensitive, who became eminent in the profession and practised world-widely but principally in the United States of America, until his particular contact with financial methods provoked such distaste that, the opportunity offering, he turned aside to concentrate upon technical literature, for which he had a liking and an already widely exercised gift.

Becoming then successfully editor of the two principal mining periodicals in the United States and one leading periodical in London, Rickard served the profession greatly by frank criticism of current events and tendencies; never one who trembled to think, he courageously ventured to speak, sometimes in mordant manner of mock humility. His editorials were instinct with his individual and challenging personality. If nothing he ever wrote was uninteresting, nothing uninformative, these editorials were nevertheless his excellencies. To them his readers on both sides of the Atlantic looked forward, and remembering now look back. The driving force behind his fluent pen was a burning, almost an explosive, exasperation with sloppy thought, loose expression and dubious ethics. To him, careful writing shaped the mind as the tool shapes the hand. He encouraged mining engineers to be frank and honest with themselves, for:

> This above all: to thine own self be true,
> And it must follow, as the night the day,
> Thou canst not then be false to any man.

The flag of frank and noble criticism Rickard flew gaily. Independent and subservient to none, criticizing the thing and not the person, he was happy in the work of creating a sound public opinion in the mining world. Approval was not often expressed—it was not his line; if doings were left alone it might be taken that they had a measure of his approval or were not worthy of his pen. Nevertheless, Rickard in addition to admirers had a host of personal friends, his sparkle and radiant alertness making him an enjoyable companion in spite of a pardonable egotism. With this happiness there came, however, a growing lament that personal hurt was occasionally felt though not intentionally given. But his criticism being impersonal there was no bitterness, and being effective his work became complete. So, again, he opportunely turned aside, now to enter the paths of the wider scholarship.

Carrying his critical faculty and his knowledge of metals into archæological and anthropological research, and offering them in that field with real humility, Rickard has been of signal service in correcting some assumptions made on incomplete metallurgical knowledge, and in making a scholarly contribution in his "Man and Metals", the impulse to writing which lay in the provoking lack of appreciation by Wells in his "Outline of History", of the important part played by metals in man's development and history.

All these services the profession on both sides of the Atlantic has recognized by its highest awards and appreciative citations, the occasions receiving some description in this retrospect. An editor lives in his editorials, an author in his books, and Rickard having been both there might remain little beyond episodes and names for an autobiography to disclose. But into this retrospect a new interweaving of personal emotion with a universal theme is brought, the love of a man for his country. Gradually the story is unfolded of a cultured Englishman living long in the United States and becoming there almost a public character, finding himself with the entry of America into the Great War at last in such completeness of sympathy with the country and the people as to feel that in all spiritual essentials that country and his England were as one; with the natural consequence that to remove the last barrier to those around him, he became an American citizen, only then in deep disappointment and dismay to find himself, or so he thought, not accepted as a 100 per cent American, not to be until he shed his English culture. That being impossible he crossed into British Columbia, where with great contentment he became British again.

Dominant personalities have their foibles; it is

as though the finite were necessary to preserve infinity from nothingness; and it is all in keeping that in this retrospect occasional trivialities appear, and that in places the straining for impressiveness is too evident. But such foibles are part and parcel of a man the profession holds in honour and friends hold in esteem and affection. Englishmen, too, will be proud of this stalwart countryman of theirs. Accordingly, this lively and most interesting story of the critic in action and of the man in intimacy makes a wide and informative human appeal.

S. J. TRUSCOTT.

Elementary Work in Zoology

Laboratory Studies in Comparative Anatomy By Dr. W. C. Senning. (McGraw-Hill Publications in the Zoological Sciences.) Pp. ix+188. (New York and London: McGraw-Hill Book Co., Inc., 1937.) 10*s*. 6*d*.

HERE is the method of conducting the first-year course in comparative anatomy at Cornell. The student is to provide himself with a text-book, drawing materials and specified dissecting instruments. Then he is to have a set of outline plates, some filled in for use with this manual—and he is told precisely how to fill up the outlines. These are to present to the student "readily available, summarised information". Three animals, namely, the shark, a newt (*Necturus*) and the cat, are chosen to supply a "structural framework" for "subsequently acquired knowledge", the student by his careful studies to absorb "as much information as can be grasped". The student is also indulged in "oral discussions by the laboratory instructor" and "oral and written quizzes and dissection checks". Let us say at once that the author has carried out his ideas admirably, and the student is to draw figures of what he has learnt from his dissections on fifty-four plates. He will be an encyclopædia of facts about his three animals and presumably he will have learnt a little dissection and some elements of drawing; his chief asset will be that he has learnt to observe and record topography with accuracy; his memory is improved and he has acquired much information.

But we deduce from the preface that the author aims to prepare his students "to do independent work". The reviewer has prepared or edited more than a dozen such laboratory manuals, for laboratory notebooks are the same thing, spaced to leave sheets for drawings. He had produced some with as detailed instructions as here—and he found them very useful for instructing large classes, especially useful for students who happened to be supplied with indifferent demonstrators; such produced the note-books in an almost verbally perfect manner for examiners, who wanted facts alone. Many of his most elementary students were 'medicals' and they, desirous of putting behind them a disagreeable first M.B., were happy. Their joyous life continued, for they kept the same compartment of mind for anatomy and only had to develop a second chamber for physiology, the two not provided with communicating doors until much later, when the students learnt that their business was with a living animal.

To the real student of science such 'manuals' were fatal, and from the commencement the reviewer began to whittle them down. To be of any subsequent use or to employ his knowledge for his own pleasure, a student must acquire independence and be allowed considerable latitude in choice of interests and methods. The anatomy of this manual is not science—this remark applies also to most text-books—and indeed is boring to the young. The latter centres his interest on the living animal, how it lives, moves and reproduces; in other words, is adapted to its place in the world. He then demands how the functions consequent on this life are performed and what sort of organs produce them. The interest of comparative anatomy is not closed, but the approach is from the living to the dead, for the latter can only be understood in the life of the former.

The 'laboratory instructor' has not the function of driving facts into dull minds, but to encourage his pupils to inquire for themselves and to help them to do so. Zoology will be killed by the use of such methods as suggested in this manual, methods in vogue when the idea of evolution was very young, but completely past to-day. Huxley was a great teacher of comparative anatomy, but his most used book was his "Comparative Physiology", which can profitably be read as an introduction to anatomy even to-day.

Are the methods of this manual those which are commonly adopted in American universities? If so, the reviewer understands why he has repeatedly had to place trained American students in his most elementary classes.

J. S. G.

The Teaching of Chemistry

(1) A Higher School Certificate Inorganic Chemistry
By G. H. J. Adlam and Leslie Slater Price. Pp. viii+624. (London: John Murray, 1938.) 8*s*. 6*d*.

(2) Inorganic Chemistry for Schools and Colleges
By Leonard A. Coles. Pp. 384. (London, Bombay and Sydney: George G. Harrap and Co., Ltd., 1938.) 6*s*.

(3) A Modern School Chemistry
By A. J. Mee. (Dent's Modern Science Series). Pp. ix+500+9 plates. (London: J. M. Dent and Sons, Ltd., 1938.) 4*s*. 6*d*.

(4) Elementary Inorganic Chemistry
By Sylvanus J. Smith. Pp. viii+400. (London: Macmillan and Co., Ltd., 1938.) 4*s*. 6*d*.

THE teaching of science to-day forms an important part of the curriculum of our public and secondary schools. The standard of teaching in chemistry was probably never higher than it is now, and the number of pupils passing through the advanced courses in science is greater than ever. There is, therefore, a need for really sound elementary and intermediate text-books of chemistry, like the four now under review.

All are intended for use in schools with pupils taking the matriculation and higher school certificate examinations. Each possesses qualities that will commend it to the discerning science master. They all appear to cover the subject fully, they are well illustrated and contain plenty of questions. Indeed, there are no fewer than 800 in Mr. Mee's book, whilst Mr. Smith not only includes a selection after each chapter but also gives a series of complete test papers at the end of the text. The fact that all these authors have included carefully graded exercises for the pupil to work through is an indication of the importance they attach to this essential part of schoolwork in chemistry. Suggestions are also made for further reading and these will doubtless attract the keener pupils, but it should not be overlooked that the study of chemistry in schools is a comparative one, and even the best pupils will find their memories taxed unduly if they are not guided in their reading.

The universities obtain their science students from the pupils who have passed through the courses for which these books have been written. Students who have used such books with care and understanding should enter the university with a sound foundation of knowledge in chemistry.

(1) The high standard now attained in chemistry as taught in secondary schools is demonstrated in the first of the books under notice. This might well be expected since one of the authors is the experienced editor of the *School Science Review*. It is arranged in three parts and altogether extends to fifty-nine chapters. The two major parts deal respectively with general and theoretical principles, and a detailed description of the elements and their commoner compounds. The third part gives a short account of the chemistry and physics of the atom, radioactivity and related phenomena.

Among the more noteworthy features of this work are the lucid accounts of recent developments, such as the preparation and study of heavy water, and the modern views on valency and atomic structure. The references to physical chemistry are adequate, whilst those organic compounds of which a knowledge is essential for an understanding of the general properties of carbon are also described.

(2) Mr. Coles's "Inorganic Chemistry", he says, "deals only with the material side of chemistry" and leaves physical chemistry to be studied elsewhere. It does, however, cover the subject concisely and fully, giving a comprehensive account of the metals, following a scheme based upon the periodic classification of the elements, and describing the latest industrial and laboratory practice. The order of treatment is unusual. Chapters on hydrogen and water precede those on the inert gases, the alkali metals, the coinage metals, etc., as the author proceeds through the groups of the periodic table. In his hands the result is very successful.

(3) Mr. Mee has aimed at providing a complete text-book of chemistry for schools as far as the standard required for the school certificate examination. Actually he has gone rather beyond his original intention, for he includes a good deal of higher work (for example, the chapters on the hydrocarbons and "Some Important Carbon Compounds") as well as sections dealing with simple qualitative and volumetric analysis. The practical experiments selected for classwork are designed for completion within a working period of forty-five minutes.

(4) Conciseness and completeness characterize Mr. Smith's "Elementary Inorganic Chemistry",

which follows well-tried lines in its manner of treatment, upon which much thought has evidently been spent in order to produce an up-to-date and accurate text-book. The early chapters give the methods and principles of chemistry and are followed by others dealing in detail with the non-metallic elements and their compounds. The metals, about a dozen of which are described, are dismissed in sixty pages. Thus the book meets the requirements of those who wish to proceed further with chemistry and also of those who will discontinue the subject after leaving school. These latter should, however, be able to take away an impression of chemistry that will be of use in after-life. For the teacher, this book has a convenient three-page index to experimental work in addition to a full general index.

G. D.

The Ways of the Weather

Weather Science for Everybody
By Prof. David Brunt. (Changing World Library.) Pp. xii+170+6 plates. (London: Watts and Co., 1936.) 2*s*. 6*d*. net.

APTLY was meteorology described half a century ago as the "Cinderella of the Sciences": in those days it was a humble study indeed, attractive in the main only to amateurs and scorned by the majority of physicists. But Cinderella, as we know, could not be kept in the background; eventually she triumphed over her elder and more ambitious sisters. Is it to be the same with meteorology? From the utilitarian point of view the answer must surely be: Yes. Having regard, in particular, to the future development of weather forecasting and to the potentialities of stratospheric flight, it is indisputable that meteorology has the major part of a very important career still ahead.

Realization of this rather obvious fact seems to have come earlier to Germany, the United States and several other nations than to Great Britain. For here, and, indeed, throughout the entire Empire, there is still but one professorship of meteorology—at the Imperial College of Science and Technology, London. Prof. D. Brunt, who now holds that solitary post, is known to meteorologists all over the world for his valuable treatise "Physical and Dynamical Meteorology", first published in 1934. Having thus catered for the more learned brethren—those mathematical physicists who seek to solve the many obscure problems of the atmosphere—Prof. Brunt has wisely turned his energies to instructing the laity. Wisely, we say, because educational authorities, like business chiefs, are necessarily guided in the provision of their supply by consideration of the demand. If meteorology is to take its proper place among the sciences taught in our universities, there must be the requisite plea from the younger generation for facilities for tuition. This plea is most likely to be incited by popular books of the kind that Prof. Brunt has written.

The little work before us is one of the best of its type in the English language. Tersely, simply and unpretentiously, it sets forth as much of its subject as can be understood by the ordinary reader not at all heavily equipped with mathematical and physical training. Doubtless in the knowledge that many people have the habit of glancing at the beginning and end of a book before deciding to read it through, the author starts and finishes with chapters certain to have a wide appeal—"Weather and Human Affairs in Peace and War" and "How Climate and Weather Affect Health and Comfort". It is safe to say that few potential readers thus caught by Prof. Brunt's wiles will fail to follow him through the remaining twelve chapters. While all fourteen are meritorious, those on radiation and the world's climates may be singled out for special mention.

Among the occasional slips noted are a misleading account of the methods of infra-red photography, on p. 40, an erroneous specification (temperature for pressure) of the ordinates in the diagram on p. 98, and the assertion on pp. 142–143 that the winters from 1930–31 to 1935–36 were all fairly mild in London. Actually, the winter of 1933–34 was the third coldest of the present century at Greenwich Observatory, with a mean temperature about 2° F. below the average. Surely, too, the English spring repeatedly refutes Prof. Brunt's statement on p. 65 that "snow can reach the ground only when the temperature even at the ground is down to freezing-point, or at most a degree or two above it". There are numerous records of true snow-flakes (as distinct from soft hail) having been observed during March and April on occasions when the surface air-temperature exceeded 40° F.

In view of its modest price, Prof. Brunt's book is very well produced and most generously illustrated, not only with line-diagrams but also with several excellent photographs.

E. L. HAWKE.

Annals of the Solar Physics Observatory, Cambridge Vol. 5, Part 1: The Spectrum of Fe II. By Dr. J. C. Dobbie. Pp. v+59+4 plates. (Cambridge: At the University Press, 1938.) 7*s*. 6*d*. net.

PART I of vol. 5 of the "Annals of the Solar Physics Observatory", Cambridge (by Dr. J. C. Dobbie, under the direction of Prof. F. J. M. Stratton), is a complete account of our present knowledge of the spectrum of ionized iron (Fe II) in the region 2150–6228 A.

Previously to this work, the classification of the spectrum of Fe II was in the main that of Prof. H. N. Russell, who in 1926 identified some two hundred lines and sixteen terms.

The material used by Dr. Dobbie was initially that obtained by Prof. H. F. Newall and the late Bryan Cookson, and largely extended by many new plates taken by Mr. W. Moss on the 21-ft. Rowland grating of the Solar Physics Observatory, Cambridge, and some confirmatory plates in the ultra-violet taken by Prof. H. Dingle at the Imperial College of Science and Technology, London. In the photographs the lines run from pole to pole of the iron arc, and the principal method of picking out lines due to Fe II was to note the lines that were only present at the poles or that were stronger at the poles than in the central part of the arc. Dr. Dobbie has extended the number of classified lines to some 1,700 and has identified 73 terms involving 218 levels. The spectrum presents several peculiar features of interest; in many multiplets the intensities are anomalous and attention is directed especially to the line at 2272·719 A. ($a^4D_{\frac{5}{2}}-z^4D^\circ_{\frac{7}{2}}$) which has an intensity of 1 only, on the scale used, instead of 9 as was to be expected

Several years patient and skilful labour have gone to the production of this achievement. For progress in astrophysical research, and in certain branches of physics proper, there is great need of the classification of more spectra, and of more detailed or extensive classification of many already partially classified. Few in Great Britain devote much attention to this type of work; the results are perhaps not very spectacular and in addition to the great consumption of time, considerable skill has to be acquired before the solution of this kind of physical 'crossword puzzle' can be profitably attempted. It is probably only in institutions with a permanent research staff that such work is likely to be done, and we welcome warmly this successful extension of the work of the Solar Physics Observatory.

J. A. C.

British Rainfall 1937:
the Seventy-seventh Annual Volume of the British Rainfall Organization. Report on the Distribution of Rain in Space and Time over the British Isles during the Year 1937 as recorded by over 5,500 Observers in Great Britain and Ireland. (Air Ministry: Meteorological Office. M.O. 427.) Pp. xx+293. (London: H.M. Stationery Office, 1938.) 15*s*. net.

THE rainfall of 1937 over the British Isles as a whole was 104 per cent of the average, being 110 in England and Wales, 91 in Scotland and 103 in Ireland. This distribution was remarkably similar to that of 1936. The main features of the map showing the distribution of the rainfall as a percentage of the average are the large area in the north-west of Scotland with less than 80 per cent, and the areas in the south-east of England with more than 130 per cent—with more than 150 per cent at Southend, Clacton and Boston. There was a great excess of rain up to the end of May, greater than in any similar period since 1870, but owing to subsequent dry months the total excess for the year, as indicated above, was small.

March and December were outstanding as snowy months. Among heavy thunderstorm downpours of the year, those of August 13 in the London district and of July 15 over a belt of country stretching from Somerset to Lincolnshire may be cited. Approximately 6 inches of rain fell at Boston for the third time since 1930, the other occasions being on July 11, 1932, and August 8, 1931—a remarkable cluster seeing that the previous greatest fall in a day in that town half a century or so ago was only 3 inches.

This year's special articles comprise one by Miss L. F. Lewis on wind velocity measurements at the level of the rim of the rain-gauge at Holyhead, and two by Dr. J. Glasspoole, on the wet and dry periods of 1937 referred to above, and on rainfall over the British Isles during the period 1901–1930, in which a comparison is effected with the period 1881–1915 still employed as a standard. L. C. W. B.

Handbuch der Vererbungswissenschaft
Herausgegeben von E. Baur und M. Hartmann. Band 2F: Genmutation. 1: Allgemeiner Teil. Von Hans Stubbe. Pp. iv + 429 + 1 plate. (Berlin: Gebrüder Borntraeger, 1938.) 60 gold marks.

THIS extensive and thoroughgoing account of gene mutations begins with a historical survey of 43 pages which contains many early records of mutations in plants and animals. A full account is given of *Chelidonium majus laciniata*, which appeared in 1590; also accounts, with photographs, of the Ancon sheep, the Manx cat, laciniate-leaved syringa and alder and many others.

The main part of the book is taken up with a record and analysis of the modern work with gene mutations. This includes accounts of polygeny, heterogeny, pleiotropy, dominance, etc.

The section on the quantitative study of mutation phenomena includes the determination of spontaneous mutation rates, the experimental production of mutations by X-rays and other methods, with a detailed analysis of the processes by which X-ray mutations are produced.

The short concluding section on the nature of the gene includes not only a historical background, with the views of Darwin, Naegeli, Weismann and de Vries, but also the most recent ideas of gene structure, by Koltzoff, Demerec, Muller, Wrinch, Timoféeff-Ressovsky and others.

An extensive bibliography is appended and also a large chart classifying all the known types of somatic and gametic mutations. While there are omissions, it will nevertheless be a very useful work of reference.

Towards Angkor:
In the Footsteps of the Indian Invaders. By H. G. Quaritch Wales. Pp. 249+32 plates. (London, Bombay and Sydney: George G. Harrap and Co., Ltd., 1937.) 12*s*. 6*d*. net.

THE great expansion of Indian cultural influence, manifested most conspicuously in art forms and concepts, which accompanied the spread of Buddhism, did not fail to affect south-eastern Asia. From the early centuries of the Christian era, traders and colonists were carrying with them to lands known to the modern world as Siam, Cambodia, Annam, Sumatra and Java, and even far distant Celebes, a culture of which the material forms as known to us culminate in the Javanese temple of Burobudur and the Cambodian Angkor Wat. This culture still survives, mingled with other elements, in the, until recently, isolated island of Bali. Not the least remarkable feature is that although this movement originally was Buddhist, it presents even in its early stages the spectacle of a close and amiable association with the cults of Hinduism.

Owing to the absence of historical record of the early stages of this expansion—even mythological reference is scanty—this field of civilization, if not entirely uncharted, has remained unexplored. In "Towards Angkor", Dr. Quaritch Wales places before his readers a connected outline of the course of events and the cultural developments in south-eastern Asia, which led up to the great efflorescence of monumental art under the great Kmer empire of the twelfth century. This he is able to do in great measure through the remarkable discoveries of two archæological expeditions sent out by the newly formed Greater India Research Committee in 1934–35 and 1935–36, of which he was the field director. These two expeditions placed in his hands the key positions for unravelling the evidence of this cultural development. Of these the first is the identification of the trans-peninsular route from Takuapa River (Takola Mart) to the Bay of Bandon, and the second the identification of Chaiya to the north of the Bay of Bandon as the centre of a vast maritime empire, which dominated south-eastern Asia for five centuries.

The Journal of the Institute of Metals
Vol. 61. Edited by G. Shaw Scott. Pp. 332+29 plates. (London: Institute of Metals, 1937.)

THIS volume contains sixteen papers which have been presented before the Institute. Dr. D. R. Pye in the Autumn Lecture discusses some outstanding metallurgical problems arising in aero-engine design. Consideration is also given to the physical nature of metal surfaces from the point of view of friction and lubrication. Literature and published experimental data bearing upon inverse segregation are summarized in a contribution by N. B. Vaughan, and accounts are given of the various theories relating to the phenomenon. A second review is by L. Kenworthy of the methods available for assessing the protective values of zinc coatings on iron and steel. Average weight, uniformity, structure and porosity are attributes of the coating affecting corrosion resistance, and for its evaluation the usefulness of the Britton electrolytic test is strongly emphasized.

A study by H. Unckel of the macro-structural deformation of multi-phase alloys during cold rolling is of interest, dealing as it does with a hitherto neglected field. Constituents of varying hardness in these alloys interfere with the plastic flow of the metal, and extra stresses arising from secondary flow around the harder constituents may cause increased brittleness. The determination of alumina in the presence of metallic aluminium by a volatilization process using hydrogen chloride is described by Messrs. Brook and Waddington.

The acknowledged high standard of contributions to the *Journal* is well maintained.

A Text-Book of Qualitative Chemical Analysis
By Dr. Arthur I. Vogel. Pp. xi+383. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1937.) 7*s*. 6*d*.

DR. VOGEL'S book, which he says is based on several years of experience in teaching the subject, is one which has many very good features. The introductory chapter on theory is much more informative and modern than those usually found in elementary books on qualitative analysis, and provides a sound basis for the practical work. The descriptions of reactions and group separations are very clear and detailed, so that the work of the teacher should be made easy. A good feature in this part is the care taken by the author to provide accurate equations for the reactions, since without an appreciation of these, qualitative analysis loses much of its value. Reactions of some rarer elements which nevertheless may be encountered in common materials are given. The model analyses at the end will be useful to students in showing how results should be set out in practical examinations.

The book may be recommended as a sound and accurate treatise of moderate price, which deserves to become popular. If carefully studied, it will provide an excellent guide to the student from the early stages in his career up to the honours courses.

Molecular Beams
By Dr. R. G. J. Fraser. (Methuen's Monographs on Physical Subjects.) Pp. ix+70. (London: Methuen and Co., Ltd., 1937.) 2*s*. 6*d*. net.

DUNOYER'S method for projecting beams of atoms or molecules through a vacuum has been applied in many branches of physics. Dr. Fraser describes particularly in this monograph its use in investigating atomic collisions, and magnetic and electric moments. It is evident that the potentialities of the method are extensive, whilst one gains the impression that its technique is not unduly difficult. The book is scarcely one for ordinary undergraduate reading, assuming as it does a considerable background of advanced physics, but as a survey of the subject for research workers it can be recommended wholeheartedly. The diagrams are clear, and there is an adequate index.

Correlations and Culture: A Study in Technique*

By Prof. Griffith Taylor

GEOGRAPHY links the four 'environmental sciences' of geology, physics, astronomy, botany, with the four 'human sciences' of history, anthropology, sociology and economics. There are vast uncharted areas on the borders of regional geography—the core of our discipline—which merge into the eight subjects specified. Among professional geographers, the great majority will always carry on the vital work in the central fields—but we may always hope for Raleighs, Drakes, Hawkins's, and Dampiers, who will explore far afield and extend our realms. They will perchance trespass on other empires; and doubtless some conservative historians and anthropologists will call them buccaneers or pirates. Dropping metaphor, I firmly believe that by applying techniques learnt in the realms of geography, biology and geology—and carried across to anthropology, history and sociology—such pioneers will ultimately earn the respect of the leaders in the 'purer' social sciences. But I must caution any piratical young geographer who cruises in strange waters that his reward, if any, will probably be a posthumous one.

It was my use (on world maps) of the isopleth method in charting the criteria of race, in conjunction with the findings in W. D. Matthew's memoir "Climate and Evolution", which led me to publish the "Zones and Strata Classification of Races" in 1919. The general principles of this concept are illustrated in Fig. 1. Here three parallel cases of evolution are considered. All anthropologists will agree as to the explanation of the block diagram (Fig. 1 *A*). Here we see zones of *methods of transport* (ox-team, horse-bus, motor-car and aeroplane) arranged round the city of Sydney—the only settlement of note for sixty years in Australia. The 'strata' resulting from this evolution in Sydney and gradual migration to margin are indicated on the vertical edge of the block diagram. Clearly there is a common cradle-land, where commercial activity is greatest, in the centre of the zones—and the primitive types now occur precisely where they did *not* originate.

Turning to Fig. 1 *B*, we find the same process illustrated in the evolution of the artiodactyls (or even-toed mammals) based on data given by Matthew. The antelopes are earliest and are displaced farthest from the centre. The sheep are latest and still characterize the common cradle-land. The fossil strata are in accord, using the palæontologist's 'law of superposition'. No biologist doubts that the zones and strata in the case of these mammals indicate the order of migration and of evolution for the artiodactyls.

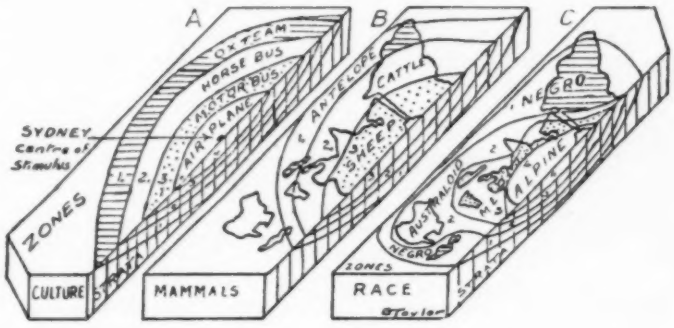

Fig. 1.

BLOCK DIAGRAMS ILLUSTRATING THE 'ZONES AND STRATA' CONCEPT APPLIED TO CULTURE (EVOLUTION OF TRANSPORT); MAMMALS (ARTIODACTYLS); AND MAJOR RACES.

In each case the centre of evolution is in the centre of the zones, and the most primitive types have been thrust to the margins. The strata appear on the vertical edges (at right). All much generalized.

I believe that primitive man was differentiated into the five major races long before the later races reached Western Europe. This evolution almost certainly took place in Asia and occurred before the last Ice Age. It certainly far antedated early Neolithic times. It is probable that the first Alpine peoples reached France (Solutré, etc.) in Aurignacian times; and Koeppen dates this as far back as 74,000 years ago. Neolithic times in France were only 8,000 years ago. Hence early

* From the presidential address to Section E (Geography) of the British Association, delivered in Cambridge on August 18. The following topics were discussed and illustrated: (*a*) geography and the social sciences; (*b*) geography and history; (*c*) evolution of life and culture; (*d*) relations of culture and race; (*e*) ecological approach to problems in culture; (*f*) correlations in the distributions of languages; (*g*) ecological notes on the Aryan problem; (*h*) the race of the Aryan-speakers; (*i*) graphs of culture-growth; (*j*) determinism versus possibilism, in Canada and Europe; (*k*) culture in the twentieth century; (*l*) bibliography; extracts from Sections *c*, *e*, *g* and *j* only have been selected.

man of such a primitive type can surely be considered as obeying the same laws of migration as the higher mammals. If now the pre-Columbian distribution of the major races (Negro, Mediterranean and Alpine) be plotted in a block diagram (Fig. 1 *C*), we find a series of *zones and strata* closely resembling the two already charted. It is difficult to escape from the conclusion that the centre of Asia is the common cradleland where evolution progressed most actively in the case of primitive man—just as Matthew has shown it progressed most actively here to produce new types of the earlier mammals. Indeed, we can almost exactly parallel the spread of the rhinoceros from Asia with the spread of the negroes, while the spread of the Pleistocene Equidæ is the same as that of Alpine man.

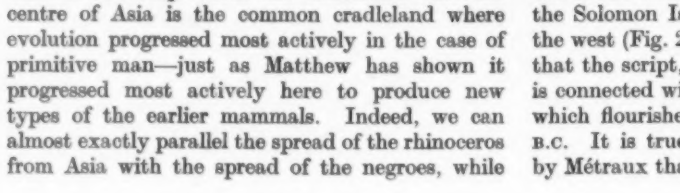

Fig. 2.

THE SPREAD OF CULTURES FROM INDIA EASTWARD; SHOWING THE MUNDA-AUSTRALOID CULTURE AT THE BOTTOM, COVERED BY DRAVIDIAN, POLYNESIAN, ARYAN, BUDDHIST AND MOSLEM 'STRATA'.

In the inset are compared some signs from the Mohenjo and Easter Island scripts. All much generalized.

The centre of stimulus in Fig. 1 *A* was the commercial progress in the city. In the case of the mammals and man it was the stimulating climate of south central Asia.

We may use as an illustration of the value of the 'zones and strata concept' that complex of races and cultures which characterizes the Indian and Pacific areas. I have had the advantage of travelling widely in Eastern Asia and in the Pacific, and this has focused my attention on the general principles underlying dispersion in this area. It is quite obvious that every widespread characteristic in Polynesia has migrated from west to east—and that any cultural contacts with America can be completely ignored in a general study. Let us examine the data in Easter Island—the farthest of these isolated groups from Asia (Fig. 2). It is almost 14,000 miles from the Caspian area to Easter Island, yet I hope to demonstrate a culture sequence stretching across all this vast expanse.

Two remarkable features in Easter Island are the well-known stone statues and the undeciphered script incised on wooden tablets. There is no reasonable doubt (as the Routledges have shown) that the statues, with their bird-man decorations, are of the same culture-complex as is common in the Solomon Islands, some six thousand miles to the west (Fig. 2). Hevesy and Hunter are satisfied that the script, the only one used by Polynesians, is connected with the remarkable Mohenjo culture which flourished in the Indus region about 3000 B.C. It is true that objections have been raised by Métraux that the script was not understood by any living Polynesian, and that the tablets of mimosa wood, etc., are not likely to be many centuries old, some indeed being modern in origin. I think that these objections are not very relevant. Our own alphabet is said to originate from not very similar signs used by miners in Sinai, though all the links are not yet clear. The question surely is to determine the origins of the remarkable Easter script—and to my mind, the Mohenjo theory is plausible and indeed probable. Moreover, it offers a good illustration of clues which may be furnished by an ecological approach.

Let us consider some of the major culture changes in the Indus region. Gordon Childe has given data as to the races which have been discovered at Mohenjo. Australoids, Mediterranean, Armenoids and Mongoloids were all present. There can be little doubt that the first settlers (before 3000 B.C.) were the aboriginal 'Australoids' who spoke a Munda language. Many members of this zone of peoples are now found 'pushed to the margin' in the East Indies and in Australia. It is represented by stratum 1 in Fig. 2. The general belief is that the Mohenjo culture was due to the later 'Mediterranean' races who spoke Dravidian languages. This constitutes stratum 2, and in my opinion is to be linked with Dixon's 'Caspian race' in the Polynesian area.

We have little knowledge of the period 2500 B.C.–1500 B.C. in India, when the great Aryan migrations overwhelmed North India. But it is significant that the earliest stone monuments in India, which are found at Rajagrha (Rajgir) near Patna, are of a cyclopean character quite unlike the work

of the later Aryan builders, and rather resemble the mysterious early stone monuments of the Pacific. For example, the Jarasandha monument (of unknown date) is a square truncated pyramid 85 ft. wide and 28 ft. high. It is built of large uncemented blocks of stone 5 or 6 ft. across. It resembles the truncated pyramids and Maræ of Polynesia. I have suggested that this culture-complex spread out as stratum 3. The Aryan-Sanskrit complex (stratum 4) never reached Polynesia, but was carried to Java and dominated that region for several centuries after 200 B.C. In North India, Buddhism (stratum 5) flourished after 500 B.C. and was carried to Java about the eighth or ninth century of our era. It did not displace the older Hindu pantheism—but flourished alongside. Around A.D. 1400 the Moslems (stratum 6) conquered Java, and the Indian religions found a refuge in the island of Bali farther east, where they still flourish. It is not, of course, suggested that the Polynesians migrated from India, for they probably lived originally in south-east Asia. But their culture probably followed the same route as that used by the Buddhist and Moslem teachers in historic times.

We may dwell for a few minutes on the recent discoveries in the vicinity of Persia. In Mesopotamia, the earliest culture of Sumer is known as 'al Ubaid', and this contained copper tools and is younger than cultures from Susa and the adjacent Persian plateau.

To the north near Nineveh is the 'Tell Halaff' culture with wheeled vehicles, but with no metal. This is much older than anything discovered in Sumer near the Persian Gulf. Still older are the lowest cultures of *Samarra* in the same region, where they occur in debris seventy feet below a temple dated about 2450 B.C. Childe has corroborated my statement as to the cradleland of man, with his comment that the early cultures of China resemble those of Anau in Turkestan (Fig. 2). It is significant that Zoroaster, the first great religious teacher, lived in this same vital region. Thus we see that the centre of the zones of the *races* of man in Turkestan is also likely to be near the cradle of civilization.

We may use the stage-diagram to correlate our scanty knowledge as to the early wave-fronts of the Aryan languages. There are three fairly definite subdivisions of Aryan: (1) the early *Kentum* or '*K*' speeches like Gaelic and Latin; (2) the Intermediate '*P*' languages like Welsh (with which we may associate Teutonic and Greek for convenience); (3) the later *Satem* languages like Slav and Indian.

Turning to Fig. 3 some idea of our knowledge of the language distribution in Sumerian times is given in the lowest map of the series. At this time Hamitic languages were used by the Pharaohs in Egypt, akin to those still spoken by the Berbers in the Atlas Mountains. Semitic languages characterized Arabia and Syria, as they still do. Sumerian

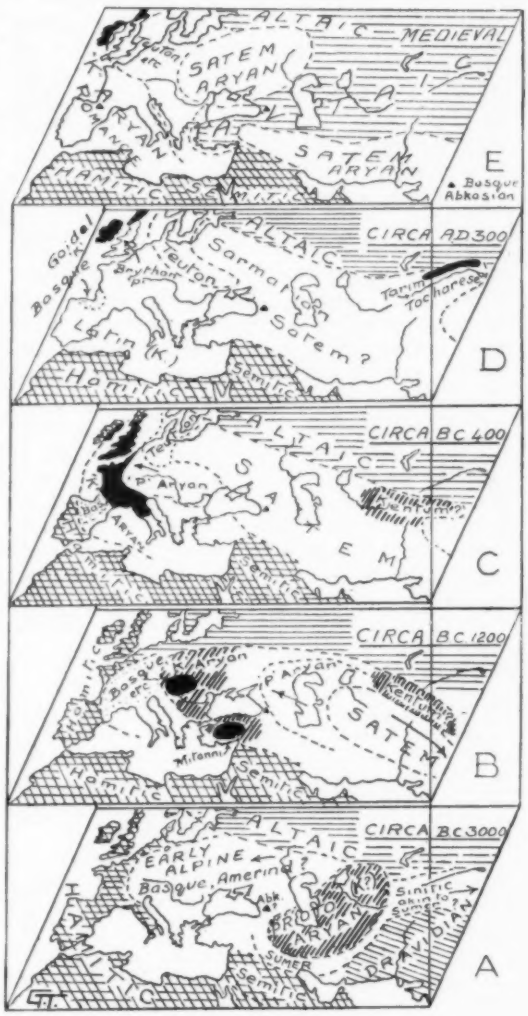

Fig. 3.

A STAGE-DIAGRAM GIVING A TENTATIVE RECONSTRUCTION OF THE DISTRIBUTION OF EUROPEAN LANGUAGES AT VARIOUS EPOCHS.

Black areas are the Primitive (marginal) '*K*' *Aryan* languages. It is suggested that the early Mediterranean race spoke *Hamitic*, and that the early Alpines spoke languages akin to *Basque*, *Abkasian* (and Amerind ?). Aryan developed near the Caspian Sea and spread out in waves. The outer 'ripple' (*K*) was akin to *Gaelic*; the second (*P*) akin to *Welsh*. The latest type was the *Satem* group.

itself has some resemblances to the Altaic, though its affinities are not yet clearly understood. In Europe at this early date there were racial allies

of the present-day Hamitic-speakers—all of Mediterranean race—living in the western regions, who probably spoke Hamitic according to Rhys and Jones. Central Europe was occupied by early migration of Alpine 'Brakephs' (broadheads) of whose language we know nothing. It was almost certainly not Aryan, and something akin to 'Basque' seems most likely. In view of the important corridor linking Turkestan with China by way of the Tarim Basin, I have ventured to suggest that a linguistic kinship between early Chinese (Sinitic) and Sumerian or early Aryan is only to be expected.

In the second map (Fig. 3 at *B*), for the period around 1200 B.C., we are on surer ground. Vast migrations of 'Satem'-speakers had poured into India from Turkestan. The Hittites, who seem to have spoken an Aryan tongue somewhat akin to the Kentum Group, were in control of Anatolia. Semitic was now the chief language of Egypt and Mesopotamia.

In Central Europe (if we adopt the suggestions of Peake) Kentum languages were spoken in the regions east of the Alps, while Brythonic (one of the Intermediate '*P*' type) was that used by the Cimmerians of the Ukraine and Caucasus areas. It seems logical to assume that many Satem-speakers still remained in Turkestan, and were perhaps allied to the Sarmatian tribes.

In the next map (for 400 B.C.) we see the first great Aryan conquest in the Near East, that of the Persians. They spoke a Satem language, and it is probable that their Sarmatian kin were occupying the European steppes about this time. The latter may have been the ancestors of the Slavs, who already seem to have settled in the Vistula Basin. Meanwhile the marginal *K*-speakers (Gaelic, etc.) had reached Britain and Ireland, and still occupied parts of France. The distribution of place-names in Central and Western Europe clearly shows the migration of waves of Gaelic and Welsh speakers across much of these areas.

The conditions some seven centuries later (A.D. 300) are shown in the next map, which deals with Europe during the zenith of the Roman Empire. The marginal primitive Aryan language Latin had been carried far and wide; so that it later gave rise to Italian, French and the other Romance tongues—which are clearly offshoots of the '*K*' group of Aryan. Brythonic (Welsh) was spoken in England, South Scotland and Wales at this time, and probably in parts of the continent besides Brittany. Possibly some Hamitic dialects still persisted in the Scottish Highlands, as suggested by some of the Ogam inscriptions. Gaelic (a '*K*' language) was spoken in Ireland and in most of Northern Scotland.

Of great interest is the discovery that a Kentum language, called Tocharese, was still in use north of the Tarim Basin in Central Asia about this time (Fig. 3 at *D*). Tocharese seems, however, to have some affinities with the Intermediate and Satem groups also. Hence it may well be fairly close to the *generalized* Aryan ancestor from which all three groups of Aryan have descended. It is suggested in the diagrams that this Kentum speech had been continuously used east of Turkestan since early Aryan times.

The medieval distribution of languages, and of the three subdivisions of Aryan, is shown in the top map. To-day Gaelic is almost the sole representative of a little altered primitive Aryan speech—though the much evolved derivatives of primitive Latin are still very important languages (Jespersen, 1894). Hamitic has died out in Europe. Altaic has encroached in Hungary and Finland, and displaced Hittite and Greek in Anatolia. Semitic has driven out Hamitic in much of North Africa. 'Satem' Aryan, in the form of Russian, is in turn displacing Altaic throughout much of the U.S.S.R.

The conclusion to be drawn from this tentative geographical approach to the Aryan problem is that the waves of language have spread from Turkestan towards India, Persia and Europe. There seems to be no support for the origin of Aryan in the German or Lithuanian regions, a theory which has been strongly upheld by a number of notable continental philologists.

During the twentieth century the trend of geography has been away from the belief of Ritter in 'providential' control, and from 'environmental' control as expounded by Ratzel towards the 'possibilism' concept of Vidal de la Blache and his school. The latter geographers picture any particular region as offering almost innumerable possibilities of exploitation to man. Our material evolution, in their opinion, is essentially a matter of our own choice, depending on which of the possibilities *we* choose. I have come to a different conclusion, no doubt primarily owing to my experience in pioneer countries like Australia and Canada, where the possibilities offered by Nature to man are more meagre than in Great Britain or the United States. Indeed of these three schools, which we may label the theocratic, the geocratic and the 'we'-ocratic, I definitely belong to the second. However, I propose to illustrate by the correlative method first in a pioneer country like Canada, and secondly in the old-established culture-complex of Europe, that man is not really a free agent—but definitely a product of his environment.

A generalized economic map about 1750 shows that fish, farms, and fur had expanded to Saskatchewan. Some sixty years later, by 1810, farming had spread approximately to Detroit;

while Mackenzie was exploiting for furs the river-basin named after him. By 1870 mining was becoming of some importance, and gold, silver and iron mines were being exploited both near the St. Lawrence and on the Fraser River. Still more important, Selkirk had, more than fifty years earlier, settled his isolated band of farmers on the silts of Lake Agassiz in the heart of the continent. About 1880 the modern migration to the wheat-fields of the prairies began. In 1930 the whole north of the Dominion is being exploited not only for furs but also for metal mines; the latter in part by air-transport. Agriculture has covered most of the inland prairies, and will extend north (and into the clay belt). Manufactures have spread along the St. Lawrence from Montreal to Ottawa and Windsor, in large part owing to the bountiful water-power.

But while there have been these striking advances and changes in the type of industry, man has not really been a free agent. His advance from fur-hunting to wheat-growing is only possible where rain and sun and soil are satisfactory. *All* the fur country cannot be utilized for wheat, even if man so wishes. Using a foreign example, we shall never see hydro-electric power or coalfields leading to the development of factories in that half of the southern continent known as 'empty Australia', however much man may wish to replace the sparsest of pastoral occupation by better-paying industries. On the other hand, it seems clear to me that in the future the immense coal resources of Alberta must inevitably be utilized, as the more accessible coalfields are used up elsewhere. Man may very probably some day 'choose' (as the 'possibilist' school would say) to give up ranching in the drier parts of Alberta, and turn to manufacturing based on the almost inexhaustible coal. But he is none the less controlled by his environment.

Exaggerating somewhat, I feel that man's part in the programme of a country's evolution is not unlike that of a traffic policeman. He can accelerate, slow or halt the traffic, but he does not alter its direction. This 'stop and go determinism' has no supporters among the historians, and not many even among geographers. But it expresses something of the conclusions that I have arrived at from my lengthy study of the difficult environments of Australia and Canada.

Sense Perception and the Evolution of Colour and Pattern

THE recent symposium* and discussion on "Sense Perception and the Evolution of Colour and Pattern" held under the auspices of Section D (Zoology) of the British Association at Cambridge directs attention to a field of inquiry where the artist, the naturalist, and the psychologist may meet.

In the interrelationships between animals of the same, or of different species—as between predator and prey, between rival males, or the opposite sexes, between parent and offspring, or between members of the group—characters which exert their influence from a distance, by sound, by sight, or scent, and the sensory equipment with which such stimuli are perceived, each play a vital part.

The study of such characters, to which Dr. J. S. Huxley has applied the term 'allæsthetic'[1], involves various questions of wide interest. How far has the evolution of vision gone parallel with the development of characters serving as visual stimuli? What is the functional significance of the elaborately evolved stimulating equipment on one hand, and of the highly specialized sensory apparatus possessed for its appreciation by other animals?

The phenomena may be approached from various points of view: the nature of the allæsthetic characters themselves; the 'public' in relation to which they have evolved; the ecological significance of the relationship between the organisms concerned. Broadly speaking, the phenomena of adaptive coloration fall into three main classes, according to the visible results achieved—namely, concealment, advertisement, and disguise. The biological function of such elusive, attractive, or deceptive features varies widely according to circumstances. Through reduced visibility, they may facilitate the capture of food, or escape from the aggressor. Through increased conspicuousness, they may serve as a warning to enemies or a threat to rivals, as a courtship display, or a recognition mark. Through deceptive or mimetic effects, they may mislead the observer as to an animal's whereabouts, attitude, or identity.

Studies of adaptive coloration and visual perception have shown that there exists a close correlation between allæsthetic characters and the sensory equipment of the animals towards which they are directed and in relation to which they have evolved. Such characters therefore assume a new interest in the indirect light they throw upon questions of comparative psychology and sense perception. On these grounds it may be

* Speakers at the symposium were Dr. J. S. Huxley, Dr. H. B. Cott, Mr. D. Lack and Mr. I. H. Birkill.

concluded, for example, that the rarity of bright colours among mammals below the primates is evidence of colour-blind vision in these forms; while conversely the varied and saturated hues exhibited by different fishes and birds, and by entomophilous flowers, postulates a colour sense in the vertebrates and insects concerned. Such conclusions are borne out by the evidence of experiments upon colour vision in these groups.

The optical properties of the structures displayed also permit deductions as to the differential reception of light rays by different animals. The limits of the visible spectrum for man and for animals do not necessarily coincide. Bees, for example, are blind to red, but have a range of colour vision extending far into the ultra-violet; and it is significant that many bee-flowers reflect ultra-violet light. On the other hand, red is an efficient stimulant to diurnal birds, and it is more than a coincidence that red finds a dominant place in bird advertisements, whether their function is attractive—in the form of ornithophilous flowers, or fruit; or repellent—in the shape of aposematic insect-prey.

Allæsthetic characters may also throw light on higher faculties. It is to be noted that where visibility from a distance is required, as in characters subserving the functions of warning, threat or recognition, crude colours and simple patterns have been developed. On the other hand, characters which are employed solely or mainly in epigamic display and used at close range, like the plumes of birds of paradise, tend to be detailed, delicate and beautiful rather than merely conspicuous advertisements; and as such they suggest powers of æsthetic appreciation in the species which display them. Similarly in the field of concealment, the extraordinary degree of perfection attained by many insects and other animals in their special resemblance to bark, lichen, leaves and other objects—achieved by the combined effect of colour, pattern and posture—almost presupposes in birds (their natural enemies) those exceptional powers of visual acuity and form-perception which on other grounds we know them to possess.

Viewing the relationship in a somewhat different light, it is becoming increasingly clear from an investigation of their nature and occurrence that the so-called adaptive appearances are in fact to be interpreted in terms of visual perception—that their end is an appeal to the eye. Thus in the sphere of concealment, it is significant that the particular arrangements of colour and pattern which for optical reasons are those best adapted to reduce visibility, and which include special optical devices for obliterating the visible characters upon which recognition depends—such as differences of colour, of light and shade, continuity of surface, outline, and shadow—are those actually employed in the coloration of different cryptic species. Moreover, various patterns, especially those of the coincident disruptive type[2], contradict and frequently cut right across separate structural elements—underlying anatomical features becoming subordinate to the illusionary appearance superimposed upon them. Further, such colour schemes are largely independent, not only of anatomy, but also of affinity—a point which was effectively stressed by Sir Edward Poulton forty years ago[3]. Equally convincing is the evidence to be derived from the general habits, resting attitudes, and special reactions of cryptic, sematic or mimetic animals, when considered in relation to their conditions of life.

Modern knowledge demands considerable modification of Darwin's theory of sexual selection. While the Darwinian doctrine almost confined the effects of epigamic display to the sphere of psychology—to the female choice of mates—and as such was applicable only to displays of unmated males before pairing-up, recent research has pointed on one hand to the prevalence of displays by one or both sexes during later phases of the breeding cycle; and on the other to the far-reaching physiological effects of these and other visual phenomena in stimulating and regulating reproductive functions.

It is now recognized that displays by one or by both sexes subsequent to pairing-up and leading to coition have a profound influence in serving to promote ovulation, or to synchronize physiological rhythms connected with the readiness to mate[4,5,6,7]. These effects depend not merely upon epigamic display: they may be decided by such characters as the population density of a breeding colony[4]; the presence of correct nesting material; or of a suitable nesting site[8]. On the other hand, mutual displays during the post-nuptial period in such birds as grebes and divers, where both sexes share family duties, seem to serve as an emotional bond between the pair throughout the breeding season[10].

A distinction is not easily drawn between characters evolved in relation to epigamic display and those serving other functions involving conspicuousness. Many display characters, whether of colour or posture, have no direct bearing upon courtship. In some species, such as the Bishop bird (*Euplectes h. hordeacea*), the display apparently has to do solely with territorial claims[11]. Or again, the same conspicuous characters may in different circumstances take on different functions, as of recognition or warning, threat or courtship. Thus the ruff of the great crested grebe is employed in different ways for threat against rivals of the same sex and for display towards members of the opposite sex. The complex nature of the

phenomena has been demonstrated by Mr. David Lack, who has shown that the robin, while able to distinguish its mate from other individuals, will yet sometimes attack the headless remains of a stuffed specimen in which little more than the breast is visible.

In conclusion, it is to be noted that the study of all æsthetic characters is not devoid of application to everyday matters. Just as the form of fishes and birds has in the past been invoked to assist the marine architect and the aircraft designer, so, it may be hoped, will the coloration of cryptic animals read a much needed lesson on the principles and practice of concealment to those responsible for the applications of camouflage in time of war.

HUGH B. COTT.

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Obituary Notices

Cavaliere Filippo De Filippi, Hon. K.C.I.E.

CAVALIERE FILIPPO DE FILIPPI, who died at his home near Florence on September 23 at the age of sixty-nine years, is probably best known in England as the leader of the Italian Scientific Expedition to the Himalayas, Karakorum and Chinese Turkestan in 1913–14.

This Expedition, probably the largest and best equipped that has ever visited Central Asia, was the conception of, and entirely organized by, De Filippi. His basic idea was the connexion of the gravimetrical surveys of India and Russian Turkestan by a chain of stations across the mountain ranges—the Himalayas, Karakorum and Kuen-Lun—which separate them. This involved the accurate determination of the astronomical and geodetic co-ordinates of the stations, necessitating the use of instruments and methods of much greater accuracy than those normally used for survey work in such areas. The use of wireless time signals for the determination of the differences in longitude was the pioneer experiment in this method, and was highly successful. The anomalies of gravity deduced from the determinations made by the Expedition confirm the general conclusions drawn from those made by the Survey of India and the Russian Geodetic Service.

Complete sets of magnetic observations were made at each gravity station, and in addition, throughout the period November 1913–August 1914, full meteorological records were taken three times daily. These were extended to hourly readings from 6 a.m. to 8 p.m. during June 1914 and for the whole 24 hours during July, during which time the observers were on the Depsang Plateau. Observations for solar radiation and of the velocity and direction of the higher air currents were also made when weather permitted.

The geology of the whole area traversed was thoroughly examined by the two eminent geologists who accompanied the Expedition, and at the same time anthropological and ethnological studies were made. A topographical survey of the country was also carried out and the very interesting geographical discovery made that the Rimu glacier divided on the Central Asian watershed. The main branch forms the source of the Shyok, the largest tributary of the Indus River, while a large but subsidiary one, extending to the north, is the source of the Yarkand River, which eventually loses itself in the deserts of Central Asia.

Dr. De Filippi was responsible for all the preliminary organization of the Expedition, and during it, in addition to his work as leader and medical officer, took charge of the transport and supply work, thus leaving the scientific officers free to devote their whole energies to their own special work. All his arrangements worked without a hitch, and the success of the Expedition was undoubtedly due to his great forethought and organizing abilities, and his tact in handling all sorts and conditions of men. He had a most charming manner and made friends with everyone he met, who must all deplore his death.

The results of the Expedition have been published in Italian in seventeen large volumes, but only the general narrative has been translated into English.

Dr. Josef Rosenthal

DR. JOSEF ROSENTHAL, formerly of Munich, died at Hampstead on August 7 last. As a young physicist, Rosenthal was one of the first to recognize the importance of Röntgen's discovery to medicine, and he devoted his life to the development of the X-ray tube, with special regard to its medical use.

Rosenthal's first experiments were reported to the Deutscher Naturforscher- und Aerzte-Tag in Braunschweig in 1897 in a paper "Ueber Röntgenbilder". In the same year, he began to work with H. Rieder, the medical radiologist, and this collaboration, which lasted for more than thirty years, led to many important results. One of Rosenthal's constant aims was to reduce the exposure time necessary for X-ray photography. This made possible two of the outstanding results of his work with Rieder, namely,

the first X-ray photograph of the human thorax in a living subject (1899; later frequently improved), and the first successful attempt at X-ray cinematography of the movements of the human stomach (1909). Jointly with Rieder, Rosenthal was editor of the first "Lehrbuch der Röntgenkunde" (first edition, 1913; second edition 1924).

In later years, Rosenthal took an active interest in the development of the Deutsches Museum in Munich, especially in its Department of Radiology, an activity which found its official recognition on the occasion of the laying of the foundation stone of the new Museum, in 1928, when he was awarded the "Goldene Ring" of the Museum. A popular lecture, given in the Museum, entitled "Das Jahrhundert der Strahlen", appeared as a pamphlet in 1930.

WE regret to announce the following deaths:

Sir Henry Fowler, K.B.E., formerly chief mechanical engineer of the London, Midland and Scottish Railway, on October 16, aged sixty-eight years.

Dr. Willis R. Gregg, chief of the United States Weather Bureau, known for his work in aeronautical meteorology, on September 14, aged fifty-eight years.

Dr. Thomas C. Hebb, professor of physics in the University of British Columbia, on August 13, aged fifty-nine years.

Prof. Maurice d'Ocagne, 'free member' of the Paris Academy of Sciences, known for his work on the application of geometrical methods to the calculus, and author of the "Traité de Nomographie" (1919), on September 23, aged seventy-six years.

News and Views

Sir Daniel Hall, K.C.B., F.R.S.

THE impending retirement of Sir Daniel Hall from the directorship of the John Innes Horticultural Institution will presumably close his very long connexion with agricultural administration and research. From the time when he was the first principal of the South-Eastern Agricultural College, Wye, and throughout his directorship of the Rothamsted Experimental Station, his tenure of office as principal scientific adviser to the Ministry of Agriculture and Fisheries, and lately as director of the John Innes Institution, Sir Daniel has impressed all by his knowledge, his sound judgment and tact, and not least by his great ability as a writer and speaker. Like the late Lord Ernle, and his successor at Rothamsted, Sir Daniel excels in the art of exposition, and British scientific agriculture has indeed been fortunate in commanding the services of men of this type. Now that he has passed the stage when, in the pursuit of duty, it is no longer necessary to "rise earlier than virtue and go to bed later than vice", we hope that Sir Daniel will find occasion to continue his great interest in the social contacts of science; but no one will grudge him time to devote to oriental art and other "digressions of a man of science". Science needs men like him who can write and speak, as well as think and do, in order that its voice may be heard amidst the disharmonies of a world torn by political turmoil and social strife.

International Study of African Problems

THE Volta Foundation Congress, which met in Rome at the beginning of October under the auspices of the Italian Royal Academy for the discussion of questions relating to Africa, was attended by delegates from fourteen European countries, including representatives of Great Britain and Germany. The delegates appear from the reports of the proceedings to have appreciated to the full both the joint responsibility of the nations of Europe for the future development of Africa, which was stressed by Prof. Orestano in his address at the opening of the Congress, and the desirability of international co-operation on a broad basis in the study of conditions which is a necessary preliminary in the approach to the problems, upon the solution of which advancement of Africa and her peoples must depend. Among the topics discussed on these lines were such matters as tropical diseases, native education, European settlement, anthropological studies, communications, and the like. In view of the attitude of the delegates on these matters, it is not surprising that in the final session strong expression was given to the opinion that some permanent organization should be formed for the promotion of international co-operation in further inquiry; while it was also urged that nations other than those at present interested directly in Africa, should be invited to participate in the interests of civilization at large. While any proposal is welcome which aims at promoting study of the problems of Africa as a whole, and seeks to attract collaboration from as wide a field as possible, it may not be out of place to recall that there are already in existence international organizations, which in certain fields are doing excellent work, and are capable of ready extension, were funds available. It would, however, be premature to offer comment before the present proposal takes more definite shape.

Boundaries for University Teachers

ANY action which affects the positions of members of scientific staffs of universities or similar institutions concerned with the promotion of natural knowledge, or restricts fields of research, or is in conflict with the spirit of internationalism in science, commands the attention of scientific workers everywhere. It is on this account, and as an indication of the restrictions imposed upon the movements of university teachers by State authority, that we print the following

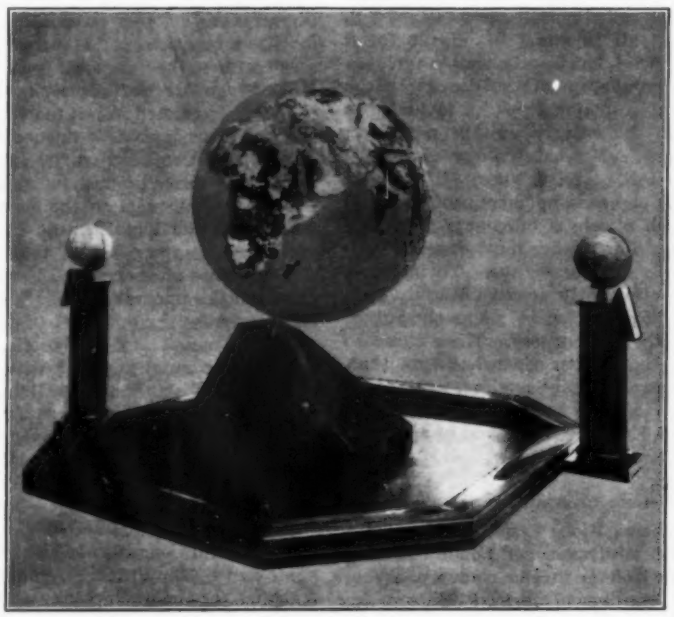
translation of a decree issued for information and action in August last in Vienna by the Ministry for International and Cultural Affairs :

"*Invitations to positions in foreign countries issued to Austrian university teachers who are non-Aryan, married to a non-Aryan or politically unreliable.*

To the Rectors of the Austrian universities and to the Dean of the Theological Faculty in Salzburg, also to the Academies of Fine Arts and to the Rector of the World Trade College.

At the instance of the Minister of Education, the attention of the Rectors and Dean is drawn to the fact that the decree of April 23rd, 1938, Z1. 12822, forbidding all university teachers to negotiate about a call to a university outside the German Empire without previously obtaining the consent of the Ministry of Education, applies also to university teachers who have retired and to others who for other reasons have ceased to occupy their positions.

Should the Rectors or Dean learn of an Austrian university teacher, retired or dismissed, who is non-Aryan, married to a non-Aryan or politically unreliable, who is trying to obtain a call to a foreign university or already preparing to occupy such a position, they must report the case here at once.—The State Commissar : Plattner."



GEOLOGICAL GLOBE AT THE GEOLOGICAL MUSEUM, SOUTH KENSINGTON.

A Geological Globe

A TERRESTRIAL globe, believed to be the largest yet prepared to show both orographical detail and the distribution of the main geological formations, was formally installed in the Geological Museum at South Kensington on October 10 by Sir Frank Smith, secretary of the Department of Scientific and Industrial Research. The globe was modelled by Mr. C. d'O. Pilkington Jackson, of Edinburgh, from data compiled by Mr. D. L. Linton. It consists of a sphere of fibrous plaster, 5 ft. 11 in. in diameter, strengthened internally by steel stays arranged around a steel tube which forms an axis from pole to pole and is tilted at 23½° from the vertical. The globe is supported by a steel spindle which is electrically rotated at a rate of one revolution in 2½ minutes. The linear scale is approximately 1 : 7,000,000, and relief is exaggerated twenty times. The geological colouring has been carried out in the Museum by Mr. C. Keefe under the direction of Mr. A. J. Butler. The colour scheme is designed to demonstrate the broad outlines of the geological structure of the continents in a fashion sufficiently simple to appeal to the non-geological visitor, and at the same time to reveal on closer inspection sufficient detail to render the globe of special use to teachers and students of geology and geography. Six distinct colours are used to indicate the sedimentary deposits of the geological eras, and the systems formed during each era are distinguished by graduated shades of the appropriate colour ; the lightest shade represents the newest system, the darkest represents the oldest. A system of stipples is used to show the age-limits of rock-groups which cannot be divided into systems. Igneous rocks appear in scarlet and orange ; and ice-caps, rivers and lakes are also marked. Provision is made for corrections and additions as new information comes to light. The geological globe bears no lettering or symbols. Two small physical globes which are mounted near it act as geographical indexes, and a sphere some 19 inches in diameter and 60 yards away demonstrates the relative size and distance of the moon.

Decibels and Phons

WE owe it largely to the public interest in the abatement of noise that two hitherto unfamiliar, but now international, units—the decibel and the phon—have come into common use. The decibel, which arrived from America via the telephone engineer, represents approximately a 5/4 geometrical increase in acoustical energy or intensity. This forms the basis of a logarithmic scale of energy levels which advance by increments of one decibel, starting from a 'zero' which is arbitrarily fixed near the threshold of hearing. The phon, which was imported from Germany, is the unit of loudness or, more precisely, of 'equivalent loudness'. It is derived through the medium of a pure tone of 1000 cycles per second which is set up as a standard of reference. Where the reference tone is stimulated by an energy level

equal to n decibels above the zero, its loudness level is declared to be n phons. If, further, the reference tone has been regulated so that, as heard by an average ear under specified conditions, its loudness is assessed as equalling that of some other sound or noise, then the equivalent loudness of the latter is also declared to be n phons.

IN this way we overcome the difficulty that energy and loudness do not necessarily keep in step when the frequency is changed; and so, through the intermediary of a device akin to the standard candle of the photometrician, we can link the phon level with the decibel level, which latter is measurable by physical instruments called noise meters. Mr. Ll. S. Lloyd, feeling that all this is too difficult for a musician to comprehend, has based a simple explanation of it on the parallelism of the decibel to the musical interval of a major third (5/4) and has published it in an attractively written pamphlet. ("Decibels and Phons. A Musical Analogy. London": Oxford University Press. 1*s*. 6*d*. net). The major third can naturally serve as an increment to build up a scale of pitch which is of course no less a logarithmic scale than any other musical scale, such as that of the more familiar octave. To interpret pitch as intensity apparently comes naturally to a race of selectively gifted 'monsters' whom the author amusingly creates for his purpose. Even those to whom the analogy may seem somewhat circuitous, will find the treatment pleasant reading, while there will, no doubt, be others, besides 'monsters' and musicians, to whom Mr. Lloyd's method of approach will commend itself.

Science and the Welfare of Animals

A SCIENTIFIC Investigations Committee has been formed by ULAWS (University of London Animal Welfare Society), which is in the course of being incorporated into the newly formed Universities Federation for Animal Welfare. The committee will concern itself with the acquisition of knowledge calculated to benefit animals in their own interests as distinct from the interests of the human species. Its functions will be to define problems for inquiry, to advise as to the allocation of funds for the purpose, and to collect and communicate any new knowledge which may be of value for increasing the well-being or diminishing the sufferings of animals. A small grant has been made in aid of an ecological investigation relevant to the control of wild populations, which is frequently carried out by methods considered by many to be inhumane. Among the other topics in which the committee is interested are the widespread failure to utilize existing knowledge o dietetic principles; the problem of bait poisons the destruction of sea-birds by oil waste; and the use of an electric goad as a substitute for the stick in droving cattle. The members of the committee are: Capt. C. W. Hume (chairman), Dr. S. Graham Brade-Birks (hon. secretary), Dr. Paul Haas, Mr. H. R. Hewer and Dr. W. R. Wooldridge. Men of science who are in sympathy with the objects of the committee are invited to communicate with Dr. S. Graham Brade-Birks, South-Eastern Agricultural College, Wye, Kent.

London Scientific Film Society

THE proposed formation of a scientific film society, which would give shows of scientific documentary films to its members and their guests, was announced in NATURE of June 4. Such a society has now been formed, under the name of the London Scientific Film Society, and its inaugural meeting was held on October 14 at the Conway Hall. At the meeting Mr. L. V. Chilton explained how the formation of the Society was a direct result of the work of the Association of Scientific Workers on scientific films. One of the functions of the Association is the promotion of a proper understanding of science by the general public, and of what science can do for society; the Association is therefore interested in the teaching of science and in the proper treatment of science on the screen. Mr. Arthur Elton referred to the London Film Society, which was formed eleven years ago and has had a broadening influence on the æsthetic film. He said that if the London Scientific Film Society is to be successful, it must reveal to the public both the achievements of science and the potentialities of the scientific documentary film. Such a society can do much to raise the standard of scientific accuracy of the films shown in public cinemas, and also to increase the number of scientific films shown. The first show of the Society will be held at 2.30 p.m. on Sunday, November 13, at the Academy Cinema. Particulars of the Society and forms of application for membership can be obtained from the Secretary at 28 Hogarth Road, S.W.5.

Faiths and World Fellowship

THE World Congress of Faiths was founded several years ago by Sir Francis Younghusband to promote a spirit of fellowship among mankind through religion. The object of the organization is to awaken and develop a world-loyalty, while allowing full play for the diversity of men, nations and faiths. There have been three congresses, in London, Oxford and Cambridge respectively in 1936, 1937 and 1938; and the proceedings have been published in volumes obtainable from the Secretary, World Congress of Faiths, 36 Victoria Street, London, S.W.1. Owing to the tension in the international situation, the committee of the Congress has decided to postpone the holding of the next congress at the American University, Beirut, and arrangements are being made for the 1939 Congress to be held in Paris. A meeting will be held in the Kensington Town Hall at 8.30 p.m. on October 31, at which Lord Gorell will take the chair, and Hindu, Jewish, Muslim and Christian speakers will deliver addresses on "The Crisis: through Faiths to Fellowship".

Air-Raid Precautions

Two publications recently issued by the British Steelwork Association, Steel House, Tothill Street, London, S.W.1, are of permanent value, although happily the international crisis is over. The first of

these, entitled "Steel for A.R.P.", suggests ways in which standardized steel products can be used for air-raid protection. One of these standard products is corrugated steel sheets and it can be used for overhead cover. Similarly the steel arches used to support the roadways of collieries are applicable to construct shelters in basements, railway embankments and cuttings. The booklet dwells on the advantages of steel frame construction from the point of view of its ability to resist explosive shock. These frames withstand stresses in any direction. A frame is not dependent for its strength upon the walls, and it can easily be repaired. Various types of wall and floor construction are described and so also are the customary brick panels. The latter are considered to be able to deal with blast and splinters when well tied up to the supporting structure. The use of pressed-steel window sub-frames can increase their strength. In existing buildings the most appropriate site for a shelter is the basement, and some useful hints are given of the best way of using existing steel products to strengthen it. The second book deals with the "Everyman" trench shelter, and will be of interest to many. It describes with the help of drawings how a householder can build a shelter capable of holding four persons and sufficient to afford protection against blast and splinters. For the roof curved sheets five feet long are used and standard flat corrugated iron sheets six feet long for lining the walls. A bill of the quantities required is given. It has been suggested that now that time is not important, there will be many who will consider it worth while to build such a shelter in their leisure hours. As the roof will be covered with the excavated soil, it might be sown or planted in such a way that the amenities of the garden would not greatly suffer.

Protecting Airships Against Fire

Some of the problems that have to be solved when protecting airships against fire, due to electric sparks in the neighbourhood of free hydrogen, are discussed in an article in *The Times* of October 18. The latest German airship, the LZ 130, which inherits the name of *Graf Zeppelin*, is denied the use of helium, and so uses hydrogen gas. Dr. Hugo Eckener and his colleagues are engaged in experiments during flight to test a project for making the potential of the static electricity within the airship frame equal to that of the electrical field outside. The experiments are based on the use of a new instrument which records the nature and intensity of the static charge in the airship and of the electrical conditions in the atmosphere surrounding the hull. Its function appears to be that of warning the captain of conditions in which it would be dangerous to 'valve' gas or to have an appreciable leak of gas. There is little danger even when the aircraft passes through a field of opposite charge, unless there is a gap in the bonded structure across which a spark may jump. If the new instrument works satisfactorily, it would give a warning when the conditions were dangerous and special precautions could be taken. It would enable the captain to see whether or not it was desirable to earth a positive charge when in the neighbourhood of a negatively charged cloud. Such stations have been made in miniature and experiments on a small scale have been carried out. Experiments will shortly be made in full scale under natural conditions.

Excavation of a Neolithic Barrow in Kent

Sir Edmund Davis's excavation of Julaber's Grave, Chilham Hill, Kent, under the direction of Mr. R. F. Jesup, in continuation of the investigations of 1937, after a brief interruption during the recent crisis, owing to the absence of the director, has been brought to a close, after being carried to a point at which it was proved conclusively that the barrow is of neolithic age. Reports of the result of the excavation (*The Times*, October 1 and 12), state that a polished flint axe, about six inches long, with flattened sides, curved edge, and made of creamy white flint, was found in a layer at a depth of four feet six inches, in which were also rough sherds, a human tooth, pointing to a burial, and a number of flint flakes, such as are found only in the area of the mound in the adjacent cultivated soil. Traces of charcoal in the core of the mound, particularly in the neolithic turf layer, support the theory that the area was cleared by burning. The polished flint axe, which substantiates the neolithic dating of the mound, is of Scandinavian type, and, it is suggested, allies the mound with the megalith builders of the Baltic, rather than with the long barrow peoples of Dorset and Wiltshire. It is certainly significant that, as the report points out, Julaber's Grave, in relation to the other long barrows of Britain, stands in a position of isolation. Further investigation of the Roman burial containing the skeletal remains of three individuals, which was found in 1937, has revealed a remarkable, and at first sight puzzling, construction of flint at the southern end of the grave. This has proved to cover the burial of a man and a horse. The head of the horse, however, is missing, and the usual platter and bowl are in fragments. Apparently the burial had been disturbed; while the flint structure had been placed there to prevent the remains, buried in the side of the mound, from slipping into the ditch.

Reduction of Maternal Mortality

The Minister of Health has communicated with local supervising authorities on methods that may be adopted in order to secure that the best obstetric aid is available to expectant mothers on occasions when midwives have to call in a doctor (Ministry of Health Circular 1705. H.M. Stationery Office. 1*d*. net). The recommendations are that a panel of doctors who will be available for this service should be drawn up for the area of each authority, and that a small advisory committee should be set up to advise the authority in regard to the operation of the arrangements and on any alteration that may be deemed necessary in order to secure and maintain a high standard of obstetric practice. It is hoped that the adoption of arrangements on these lines will help in reducing the present maternal mortality rate.

Conference of the National Union of Teachers

A BOOKLET has been issued containing eight of the addresses delivered at sectional meetings of the Annual Conference of the National Union of Teachers held in Margate in June last (London: National Union of Teachers, 6*d*. net). "Exemptions and Beneficial Employment", in connexion with the Factory Act, 1937, which has just come into operation, was the subject of addresses by Major Evan Davies, Mrs. Alderman Wainwright and Mr. F. A. Ring, who all foresee considerable difficulties for the authorities and administrators who have been given the task of working the Act. The subject of handicraft in schools was dealt with by Mr. F. Potter, who considers that the prestige of handicrafts and of handicraft teachers never stood higher and continues to increase. He expressed the hope that, in the future, room would be found for promotion to headships in the newer senior schools of the really educated and skilled craftsman.

London Lectures for Teachers

THE L.C.C. Handbook for 1938–39 of lectures and classes for teachers gives particulars of 114 courses distributed over a wide field. Nearly half (52) relate to art and crafts, music and physical education, 19 are listed under 'pedagogy' and 7 under 'science'. Among what may be called the 'star turns' are lectures on food production by Sir John Russell, on recent advances in physics by Prof. J. D. Cockroft and Prof. E. K. Rideal, on vitamins, hormones and stimulating substances by Dr. J. Needham and on astronomy by Sir Arthur Eddington. There are three courses which should prove useful on how to make use of museums (British, Victoria and Albert and London). Four deal with the important, but too often neglected, subjects of speech-training, speech therapy and backwardness in reading. Another often neglected subject will be dealt with under the title "Thinking and Writing" by Mr. R. W. Jepson at Mercers' School on lines designed to help in the training of children of 11–14 years of age to use language "as a medium for clear and exact thought and expression—to understand its structure and working and the meanings it conveys, to realize its potentialities for enlightenment and confusion, and to apply the knowledge thus gained to their own writing". The equally neglected science and art of cookery find no place in the programme except by implication in the syllabus of a course on domestic subjects.

Australian Journal of Science

THE first number of the *Australian Journal of Science* has recently been issued. This journal is published by the Australian National Research Council under the auspices of the Australian and New Zealand Association for the Advancement of Science, and six numbers will appear each year. Scientific work in Australia has developed greatly in recent years, and the need for a means of publishing short advance summaries of research has become more and more apparent. The new journal is designed to satisfy this need and also, in line with other well-known scientific journals, to publish reviews, news and views, reports of proceedings of various scientific institutes and correspondence. The first number now to hand augurs well for the success of the project. The substance of the inaugural lecture by Prof. Eric Ashby, newly appointed professor of botany in the University of Sydney, on "The Place of Biology in Australian Education" is purposely provocative and should be read with interest and profit by all biologists, but especially by those responsible in some way or another for the teaching of biology in Australia. Sir Douglas Mawson has an interesting short article on research in the antarctic. *Australian Science Abstracts* are in future to be incorporated in the *Australian Journal of Science* as a supplement. Subscription for the *Journal* is 12*s*. for one year. Further information can be obtained from the Australian National Research Council, Science House, 157–161 Gloucester Street, Sydney, N.S.W.

Institution of Civil Engineers: Awards

THE following awards of the Institution of Civil Engineers have been made for session 1937–38: *Telford Premiums* to Sir George Lee, M. G. J. McHaffie, jointly to W. C. Parker and Hubert Clarke, jointly to William Hudson and J. K. Hunter, George Ellson, jointly to F. J. Buckton and H. J. Fereday, R. W. Mountain, W. A. Tookey, F. C. Vokes, Prof. A. H. Gibson, J. F. Hay, Frank Fancutt, T. H. Seaton; *Coopers Hill War Memorial Prize* to William Hawthorne and F. H. Williams (jointly); *Trevithick Premium* to R. G. Knight; *Manby Premium* to Dr. H. J. Gough and W. A. Wood (jointly); *Indian Premium* to M. R. Atkins and D. H. Remfry (jointly). For papers published in the *Journal* without oral discussion: *Telford Premiums* to Prof. F. C. Lea and J. G. Whitman (jointly); Dr. C. F. Colebrook and Prof. C. M. White (jointly), Herbert Addison, Thomas Donkin; *Trevithick Premium* to G. C. Blofield; *Crampton Prizes* to J. R. Daymond, Serge Leliavsky. For students' papers read in London or at meetings of local associations: *James Forrest Medal and a Miller Prize* to John Hayes; *Miller Prizes* to I. S. Chisholm, A. R. Collins, A. L. Arnold, E. F. Humphries, Jack Mercer, J. M. P. Hooley.

Australian and New Zealand Association

THE twenty-fourth meeting of the Australian and New Zealand Association for the Advancement of Science is to be held at Canberra on January 11–18, 1939, under the presidency of Prof. Ernest Scott, emeritus professor of history in the University of Melbourne. This meeting is regarded as the jubilee meeting of the Association, the first meeting having been held in Sydney in August 1888 under the presidency of the late Mr. H. C. Russell. Six men of science from Great Britain have accepted invitations to attend this meeting: they are Prof. F. T. Brooks, Sir John Flett, Dr. Julian Huxley, Sir John Russell, Dr. N. V. Sidgwick and Mr. H. G. Wells. It is hoped that the practice thus introduced of welcoming a group of scientific workers from overseas will be continued at all future biennial meetings. The presidents of the sections are as follows: Section A

(Astronomy, Mathematics and Physics), Prof. T. Parnell; Section B (Chemistry), W. Russell Grimwade; Section C (Geology), Prof. R. Speight; Section D (Zoology), E. J. Goddard; Section E (History), Prof. S. H. Roberts; Section F (Anthropology), F. E. Williams; Section G (Economics, Statistics and Social Science), L. G. Melville; Section H (Engineering and Architecture), Sir Henry Barraclough; Section I (Medical Science and National Health), Dr. E. Sydney Morris; Section J (Education, Psychology, and Philosophy), J. R. Darling; Section K (Agriculture and Forestry), Dr. W. L. Waterhouse; Section L (Veterinary Science), Dr. L. B. Bull; Section M (Botany), Prof. J. G. Wood; Section N (Physiology), Prof. W. J. Young; Section O (Pharmaceutical Science), Dr. E. M. Watson; Section P (Geography and Oceanography), G. A. V. Stanley.

Announcements

THE Duke of Kent will preside at a meeting called by the Duke of Devonshire (chairman of the Society for Extending the Rothamsted Experiments) and the Earl of Radnor (chairman of the managing committee of the Station) to consider arrangements for celebrating the approaching centenary of the Rothamsted Experimental Station at Harpenden. The meeting will be held in the rooms of the Royal Society on November 1 at 3 p.m.

DR. ROBERT COURRIER, professor of medicine at the Algiers Faculty of Medicine, has been made professor of experimental morphology and endocrinology at the Collège de France.

THE Twelfth Annual Radiological Congress and Exhibition will be held on December 7–9 at the Central Hall, Westminster, London, S.W.1. The nineteenth Mackenzie-Davidson Memorial Lecture will be given by Dr. G. Shearer, and the twenty-first Silvanus Thompson Memorial Lecture by Dr. R. Ledoux-Lebard.

A COURSE of ten lectures and demonstrations on tropical hygiene for men and women outside the medical profession proceeding to the tropics, will be given by Mr. H. H. Clay, Prof. R. T. Leiper and Sir Malcolm Watson, on November 28–December 9, at the London School of Hygiene and Tropical Medicine. Further information can be obtained from the Secretary, London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.

THREE meetings of the Association of Scientific Workers open to the public have recently been announced. On October 25, Prof. A. Ferguson, Prof. H. Levy and others will speak on "Scientists and War"; on November 3, Prof. J. D. Bernal will speak on "The Finance of Scientific Research"; and on November 23, Prof. Winifred Cullis will discuss "The Film in Education". Further information can be obtained from the Secretary at Kelvin House, 28 Hogarth Road, South Kensington, S.W.5.

A CONFERENCE on Child Guidance will be held at the Royal Sanitary Institute on November 17 at 2.30 p.m. under the chairmanship of Sir Henry Brackenbury. The discussion on "What can local authorities do for the maladjusted child?" will be opened by Dr. C. L. C. Burns, Special School medical officer and director of child guidance, Birmingham. Further information can be obtained from the Secretary, Royal Sanitary Institute, 90 Buckingham Palace Road, S.W.1.

THE programme of the Sex Education Society for 1938–39 includes lectures on sex in prison, by Mr. Wilfred Macartney, on masturbation, by Dr. Wilhelm Stekel, on female homosexuality, by Dr. Adrian Stephens, on sex and the adolescent, by Mr. A. S. Neill, and on problems arising out of the new divorce law, by Mrs. M. L. Seaton-Tiedemann. Further information may be had from the Secretary, 127 Harley Street, W.1.

THE sixty-seventh annual meeting of the American Public Health Association will be held at Kansas City, Mo., on October 25–28. There will be ten sections, devoted respectively to health officers, laboratories, vital statistics, public health engineering, industrial hygiene, food and nutrition, child welfare, education in public health, public health nursing and epidemiology. Further information can be obtained from the American Public Health Association, 50 West 50th St., New York.

SMALL-POX has become an extinct disease in Poland owing to the strict enforcement of the law on compulsory vaccination and re-vaccination.

THE October issue of the *British Journal of Dermatology and Syphilis* is a jubilee number (1888–1938), containing retrospective articles by Drs. J. M. H. Macleod, James H. Sequeira and Sir Ernest Graham-Little, with portraits of the editors of the journal and celebrated British dermatologists of the past fifty years.

THE present issue of the *Nederlandsch Tijdschrift voor Geneeskunde*, the organ of the Dutch Medical Association, is a Boerhaave number containing the addresses delivered at the Boerhaave celebrations at Leyden on September 23 (see NATURE, September 17), of which the following are in English: Boerhaave's influence upon American medicine, by Prof. Henry E. Sigerist; Boerhaave and the early medical school at Edinburgh, by Dr. J. D. Comrie; the influence of Boerhaave's "Institutiones medicae" on modern physiology, by Prof. J. F. Fulton; and Boerhaave as a botanist, by Mr. T. A. Sprague.

WE regret to find that the name of S. Abdul Aziz was inadvertently omitted from the letter entitled "Raman Spectra of Compounds with Three Benzene Rings" published in NATURE of September 10, p. 477. The letter was a joint one from Prof. S. K. Mukerji and S. Abdul Aziz.

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 758.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Mechanism of Light Flicker Fusion during the Course of Dark and Light Adaptation

IT follows from the data of Schaternikoff, Fedorov and Fedorova[1], R. Lithgoe and K. Tansley[2], and others, that during dark adaptation the critical flicker frequency for photopic vision is decreased. It has been shown by Alexanian and Livshiz in Orbeli's laboratory (Leningrad) that the same is the case in scotopic vision provided the effect produced by the change of threshold sensitivity during dark adaptation is eliminated. Critical frequency was therefore always determined for a light intensity which was a multiple of the threshold at the given moment. In the course of light adaptation the critical frequency is, on the contrary, increasing (R. Lithgoe and K. Tansley). The purpose of the present study was to analyse the causes underlying the above change of critical flicker frequency in the course of dark and light adaptation. Both dark and light adaptation were therefore studied by means of a special optical device which afforded the possibility of watching in a homogeneously illuminated field (angular size about 10°) the flickering of a central point visible within an angle of 1°, the brightness of which was equal to that of the background.

The critical frequency of flicker was found to undergo a decrease during dark adaptation and a considerable increase during light adaptation, the latter only up to a certain limit, whereupon the critical frequency has somewhat decreased (Fig. 1, line "*a*"). With red and green stimuli light adaptation proceeds similarly provided the initial flicker frequencies are similar (Fig. 2). In the light of Adrian's data on the action current of the isolated optic nerve of the eel induced by stimulation of the retina with flickering light, Piper's data on isolated eyes of a number of animals (dog, ape, etc.), Sachs's findings regarding the action currents of the human eye submitted to intermittent light, as well as the data of Granit and Hartline and Graham, who have studied the impulses in the isolated optic nerve fibres without synapses in the retina of *Limulus poliphemus* (cf. also Barcroft[3]), the conclusion will seem irrefutable that fusion of light flicker takes place in the synapses layer of the retina. As to the mechanism of this fusion, it may be suggested that it results from deformation (enlargement) of impulses set up by the action of light on the cones (and rods) of the retina during the passage of the impulses through these synapses, due to the resistance they offer to the passage of the impulses. Light adaptation reduces the resistance of synapses, establishing stable connexion between them, while dark adaptation produces an opposite effect. It becomes thus comprehensible why in the course of light adaptation intermittent light seems to become progressively more bright (the critical frequency is increased), while during dark adaptation an opposite impression is produced. (Ives' concept[4] that diffusion of impulses occurs in the optic nerve fibres themselves is opposed by the recent data, according to which impulses are not deformed during their passage along the nerve fibres. Nor can we agree with Houstoun[5] that light flicker fusion occurs "before the stimulation of the rods and cones".)

Our suggestion was completely confirmed by special experiments carried out in this laboratory on the effect of strychnine injections (1 c.c. of 0·1 per cent solution) and of illumination of the other eye upon the critical flicker frequency.

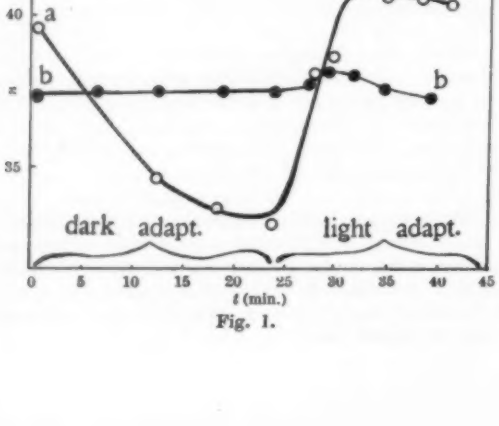


Fig. 1.

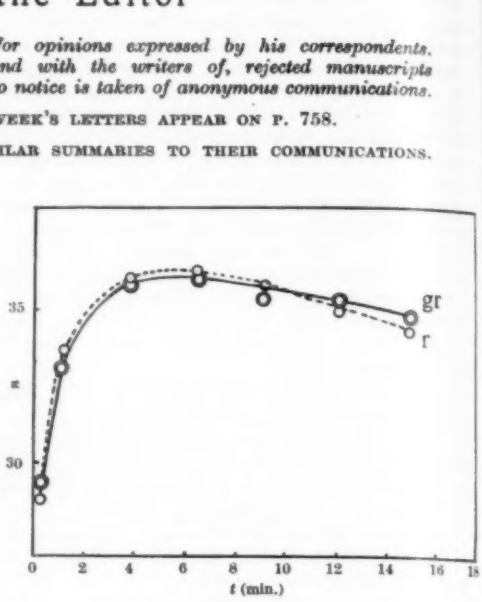


Fig. 2.

Twenty-four hours after strychnine injection, neither light nor darkness could influence the fusion of light flickers, which can be accounted for only from the point of view presented above (Fig. 1, curve *b*).

The main effect of strychnine upon the visual apparatus consists, according to Granit[6] and others*, in the establishment of stable connexions within the synapses, thus reducing their resistance in facilitating a neural interconnexion between the ganglion cells of the retina. This is also the reason why illumination of the other eye which induces centrifugal impulses in the optic nerve of the first eye is likewise ineffective. Without strychnine, the curve *a–b–c–d* is obtained; and one day after the strychnine injection, the curve *e–f–g–h* (Fig. 3). (Similar curves were obtained with a dark background.)

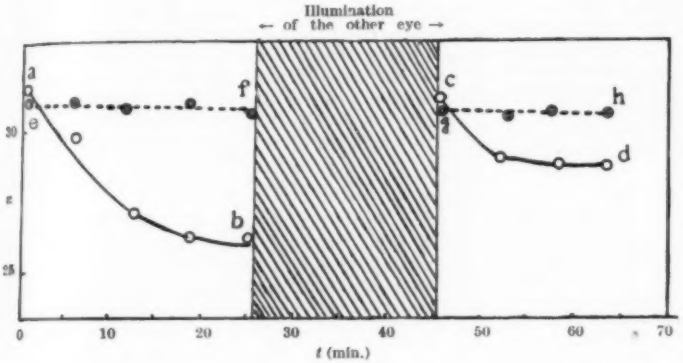


Fig. 3.

It should also be pointed out that caffeine, which renders the perception more acute (Kräpelin) and increases the excitability of the nerve elements of the cortex (Lindberg), while increasing the final threshold sensitivity of the eye, did not exert, in our experiments, any noticeable influence upon the critical flicker frequency.

The complete analogy between the critical flicker frequency during the course of dark and light adaptation with the corresponding curves for electric excitability of the eye (phosphen phenomenon—A. Bogoslovsky) renders it very probable that the electric excitability of the eye after strychnine injection will likewise not change either in light or in darkness.

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*According to Duke-Elder's "Text-book of Ophthalmology" and others (Loewenstein-Brill, Schlagintweit) strychnine does not change the threshold stimulus, but the reaction time.

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[2] Lithgoe, R., and Tansley, K., Med. Res. Council, Spec. Report Series, No. 137 (1929).
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[4] Ives, H., *J. Opt. Soc. Amer.*, **27**, 107 (1934).
[5] Houstoun, R. A., "Vision and Colour Vision" (London, 1932).
[6] Granit, R., (*a*) "Die Elektrophysiologie der Netzhaut und des Schnerven, Copenhagen", 1936 (*Acta Ophth.* Suppl. VIII); and (*b*) "The Physiological Significance of the Retinal Synapses" (Report of a Joint Discussion on Vision, 263–271; 1932).

Strontium in Sea Water and its Effect on Calcium Determinations

THE concentration of strontium in sea water from the English Channel has been estimated by Desgrez and Meunier[1] as 13·5 mgm. per litre, and this value has been confirmed by Thomas and Thompson[2], who obtained for water of 19 per mille chlorinity from the Pacific coast of America a value of 13 mgm. per litre, corresponding to a Ca/Sr ratio of 30.

In all methods of estimating calcium in sea water, it is to be expected that this strontium will be precipitated along with the calcium as oxalate, and will give rise to a positive error. Spectrographic examination of both filtrate and precipitate obtained by precipitating calcium as oxalate from sea water shows that this is in fact the case; no strontium can be detected in the filtrate, and the Ca/Sr ratio in the precipitate is indistinguishable from that in the original sea water. The error thus introduced into calcium determinations, which, though small, is much larger than the maximum analytical error of the best modern methods carefully performed, seems, however, to have been ignored by all authors, except for a statement by Thompson and Robinson[3] that "the presence of strontium is indicated when careful attempts are made to compare gravimetric and volumetric procedures for calcium in sea water".

In view of the very careful work that has been done recently, at the University of Washington and elsewhere, to establish authoritative ratios for the principal constituents of sea water, taking chlorinity as unity, it seems a pity that this error should go uncorrected. The difficulty is that the final determination of the calcium, after it has been precipitated as oxalate, may be performed in various ways; it may be estimated volumetrically as oxalate or oxide, or it may be weighed as oxalate, as carbonate, or as oxide, and the magnitude of the strontium error varies in accordance with the method employed. This may be seen from the table below.

Method	Ratio from which error is to be calculated	Value of ratio in col. 2 when Ca/Sr = 30	Error due to strontium (reciprocals of figures in col. 3)
—	Ca/Sr (by weight)	30	3·3 per cent
Volumetric estimation as oxalate or oxide	Ca/Sr (by atoms)	65	1·5 ,,
Weighing as oxalate	$CaC_2O_4 \cdot H_2O$ / $SrC_2O_4 \cdot H_2O$	49	2·0 ,,
Weighing as carbonate	$CaCO_3$ / $SrCO_3$	45	2·2 ,,
Weighing as oxide	CaO/SrO	35·5	2·8 ,,

Since no method exists of separating quantitatively small amounts of strontium from relatively large amounts of calcium, it is clearly impossible to obtain the true calcium content directly by analysis. It is desirable therefore that an arbitrary meaning should be given to the term "calcium content",

as has already been done for chlorinity, so that its value shall bear a constant and known relation to the true calcium value, and shall at the same time be ascertainable by direct analysis. Most determinations in the past have been performed by weighing the calcium as oxide; but recently volumetric methods claiming considerable accuracy have been published[4,5], and on the other hand it has been shown that calcium may be weighed conveniently and very accurately as carbonate[6].

On the whole, it seems best that a convention should be adopted in conformity with that already established for the halides, and it is hereby proposed therefore that, in speaking of the calcium content or calcium/chloride ratio of sea water, 'calcium' shall be taken to mean 'calcium after the strontium and barium have been replaced by calcium'. (The barium concentration is probably small enough to be completely negligible.) This value will be given directly by volumetric methods; to methods involving weighing as oxide or carbonate, corrections of $-1{\cdot}3$ per cent and $-0{\cdot}7$ per cent respectively would have to be applied. If this convention be adopted, the value of 0·02150 established by Thompson and Wright[7] for the Ca/Cl ratio becomes 0·02122.

The decision must, of course, be left to those competent to speak with authority on the subject of chemical oceanography.

Further discussion of certain analytical aspects of calcium determination in sea water and biological fluids of similar composition will appear shortly in a paper written in collaboration with Dr. J. D. Robertson.

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Aug. 19.

[1] Desgrez and Meunier, *C.R. Acad. Sci.*, **183**, 689 (1926).
[2] Thomas and Thompson, cited in *Bull. Nat. Research Council*, No. 85, 174 (1932).
[3] Thompson and Robinson, *Bull. Nat. Research Council*, No. 85, 118 (1932).
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[5] Gripenberg, *J. du Conseil*, **12**, 284 (1937).
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[7] Thompson and Wright, *J. Amer. Chem. Soc.*, **52**, 915 (1930).

Effects of Trimethylamine in Plants and Animals suggestive of Hormonal Influence

TRIMETHYLAMINE is known to accumulate in the sexual organs of many plants and animals[1]. Its action as an aphrodisiac has also been observed. Some connexion of trimethylamine with sex hormones appeared therefore possible. On the other hand, the effects of animal sex hormones on flowering[2] and on the development of 'phytocarcinomata'[3] having been demonstrated, a further association of ideas concerning the possibility of similar parallelisms of action of trimethylamine did not seem to be too far-fetched.

I have accordingly tested the influence of trimethylamine on plants and animals by the following methods:

(1) Trimethylamine in a 1 : 60,000 aqueous solution was introduced through a cut in the stem of young tomato plants by a method previously described[4]. On the average, 17 c.c. of the substance was absorbed by each plant during the period May 12–July 18, 1936. The effect of this treatment was an increase of about 22 per cent in the number of flowers produced, as compared with the controls to which water was administered by the same method.

(2) Another group of tomato plants was inoculated with a virulent strain of *B. tumefaciens*, five inoculations being made on the main stem of each plant. A 1 : 60,000 solution of trimethylamine was afterwards administered, using the above-mentioned technique. The control plants similarly inoculated were treated with water by the same method. As a result of the treatment with trimethylamine, the total average weight of the tumours was about 17 per cent higher than that of the controls.

(3) *Rhodeus amarus* males produce in the breeding season a characteristic colour change (*Hochzeitskleid*) and the females a marked elongation of the ovipositor. These effects can also be obtained by the administration of sexual hormones[5]. When *Rhodeus amarus* males were placed three to four months after the normal breeding season (July 1935 and August 1937) in an aquarium containing a 1 : 10,000 solution of trimethylamine, the brilliant carmine 'nuptial colour' was obtained within 60–90 minutes. No appreciable effect was observed on the females. In the concentration used, the substance proved to be toxic to the animals.

(4) In July 1935 (about three months after the mating season in Hungary), *Rana esculenta* males and females were placed in 1 : 25,000 to 1 : 6,125 solutions of trimethylamine. In less than 24 hours, moulting was observed, and in another 24 hours the normally faint designs of the epidermis became as vigorously outlined as in the mating season. From the third day on, the behaviour of the males showed an awakening of the sexual instinct, although no copulation was observed. On the fourth day, the colour change attained its maximum and lasted until the seventh day, when owing to the toxicity of the substance the experiment was discontinued.

(5) *Triton cristatus* males and females were placed about three months after the mating season in a 1 : 1,000,000 solution of trimethylamine. The successive phases of colour change similar to those observed in the breeding season had begun about two hours after the beginning of the treatment, and were fully displayed in five hours. They faded again at the end of 13 hours. The effects of a second treatment lasted 24 hours, however, and those of a third treatment until the end of the experiment, namely, 23 days. Signs of awakening of the sexual instinct were shown by the males from the sixth to the twentieth day of the experiment; but neither did their crests appreciably develop nor did copulation take place. No additional effects were obtained by increasing the concentration of the solution to 1 : 25,000.

The histological examination of some organs of the treated newts, kindly undertaken by Dr. A. Wolszky (Hungarian Biological Research Institute, Tihany), has shown the following results: the histological structure of the skin is normal, but the amount of pigment normally diffused in it is greatly reduced. The bulk of the pigment is condensed in big blocks of 120–150 μ diameter in the corium, thus differing markedly from the normal consistency and distribution. In the ovary the number of ripening eggs (filled with eosinophile yolk granules) appears to be increased. Their diameter reaches 1·2 mm. In the oviduct no histological changes were observed.

Although some of the above preliminary findings are suggestive of hormonal effects, further experiments are in hand to establish how far this claim is justified.

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Sept. 10.

[1] Czapek, Fr., "Biochemie des Pflanzen" (Fischer, 3rd ed., 1925).
[2] Schoeller, G., and Goebel, H., *Biochem. Z.*, **278**, 298 (1935).
[3] Havas, L., NATURE, **136**, 516 (1935).
[4] Havas, L., *Bull. du Cancer*, **26**, No. 6 (Dec. 1937).
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Colchicine and Acenaphthene as Polyploidizing Agents

FROM the communication by B. R. Nebel[1] in NATURE of August 6 reporting that acenaphthene solution does not induce chromosome doubling in *Tradescantia*, I believe that he is not well acquainted with the method by which I worked. In my first paper[2] I described the method as follows: "Soaking seeds from *Triticum vulgare*, *Tr. monococcum*, and *Secale cereale* in saturated aqueous solution of acenaphthene, with excess of crystals (sublimated particles), during two days and then putting them into Petri dishes, watered with the same solution, we found that the seedlings react morphologically in the same way as they react to colchicine solution" (p. 198). In the treated material polyploid cells and sectors were found. Excess of crystals was necessary (which act in the form of sublimated particles), since saturated solution alone was not sufficient to induce chromosome doubling. (I shall not quote here the further elaborations of the method[3] described in my paper quoted by Nebel, since it was published in NATURE.)

We know now quite well that the active principles[4,5,6] are the sublimated particles, since dry acenaphthene crystals act effectively from a distance in inducing chromosome doubling; therefore I am applying it now by covering the plants or the shoots with reagent tubes (glasses) or cylinders the walls of which are covered with acenaphthene crystals from inside. For some experiments we dissolved the crystals in ether, shook up the solution in the reagent tubes and cylinders, the ether evaporated rapidly and the walls of the tubes and cylinders were left covered with crystals.

Treating branches of *Nicotiana longiflora* with acenaphthene sublimating particles, I produced tetraploid and octaploid shoots from which seeds were produced and further polyploid plants were raised.

Applying colchicine solution I obtained tetraploid plants from *Nicotiana rustica*, *N. tabacum*, *N. glauca*, *N. suaveolens*, *N. megalosiphon*, *N. Velutina*, *N. alata-Sanderæ*, *N. suaveolens-alata*, *Petunia hybrida*, *P. parviflora*, etc., and octaploid in *N. alata-Sanderæ*. Treating *Lactuca* (salad) germinating seeds with colchicine solution, I obtained only polyploid cells, but no polyploid shoots or plants. Tetraploid *Lactuca* plants were obtained, however, by treating germinating seeds with acenaphthene sublimated particles from crystals.

In studying the procedure of the meiosis and mitosis in plants treated with acenaphthene and colchicine[2-7], and inducing polyploid cells, sectors and whole shoots and plants by these two agents in many species and hybrids, I have collected data on the basis of which I can affirm (contrary to Nebel) that acenaphthene interferes with the mitotic and meiotic processes in a way similar to that of colchicine, creating conditions for chromosome doubling. Thus acenaphthene can be successfully applied for inducing polyploidy, as had already been done in *Nicotiana*, *Triticum*, *Lactuca*, etc.

It should be mentioned here that the effect of the acenaphthene is increased with increase in the amount of sublimating particles and in the time of exposure. The quantum of the particles increases with increase of crystal surface and with increase of temperature (within limits). Large amounts of sublimated particles, and also a long time of exposure without interruptions, may injure and even kill plant tissues.

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[5] Kostoff, *Current Science*, in the Press.
[6] Kostoff, *Current Science*, in the Press.
[7] Kostoff, *C.R. Acad. Sci. U.S.S.R.*, in the Press.

Production of Growth-Substance by Clover Nodule Bacteria

THIMANN[1], using the standard *Avena* technique, showed that a growth-substance is produced in considerable amount in root nodules. He furthermore claimed that the growth-substance produced is not derived from the meristematic tip of the nodule, but comes directly from the bacterial tissue. He found that the symptoms induced by 3-indole-acetic acid upon roots closely resembled those produced, in Molliard's work, by the action of sterile filtrate of nodule bacteria upon pea roots, and he consequently believed that the bacteria cultivated in laboratory media produce growth-substance in considerable amount.

Using Went's pea test technique[2], I have confirmed Thimann's view that nodule bacteria do produce a good deal of growth-substance in a culture provided with a small amount of tryptophane in the medium. The filtrates of four weeks old cultures of strains of clover nodule bacteria grown in a yeast-water medium containing 0·02 per cent tryptophane were tested against pea shoots prepared according to Went's method. The results of a typical experiment are shown in the accompanying table.

	*p*H	Dilution				
		1/4	1/8	1/16	1/32	1/64
Uninoculated control	8·2	O	O	—	—	—
Strain 2057 in medium without tryptophane	8·4	O	O	O	O	O
Strain 2057	7·9	+	+	+	±	O
Strain 2027	8·0	+	+	+	±	O
Strain 202	7·8	+	+	±	O	O
Urine	–	+	+	±	–	–

+ Positive reaction. O No reaction.
± Reaction doubtful. – Not tested.

It appears that strains that are effective in fixing nitrogen in the plant produce in this tryptophane medium very little if any more growth-substance than do the non-beneficial strains that are not

effective in fixing nitrogen. The old laboratory strains which have lost their virulence, that is, are unable to produce nodules when supplied to the plant, were found in most experiments to produce less growth-substance, as illustrated by the strain "202" in the table.

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Sept. 7.

[1] Thimann, K. V., *Proc. Nat. Acad. Sci.*, **22**, 511–514 (1936).
[2] Went, F. W., and Thimann, K. V., "Phytohormones", 54–55 (New York, 1937).

Cyclical Changes in the Adrenal Glands of Spayed Rats

IN an earlier note published in these columns[1], it was reported that cyclical variations occur in the responsiveness of the uterus of spayed monkeys to constant œstrogenic stimulation. In view of several considerations, it was suggested in a later communication[2] that variations in the size and function of the adrenal cortex, such as occur in normal rats in the œstrous cycle[3], may be responsible for these cyclical variations in the uterine response. Later work[4] showed that cyclical uterine changes occur in spayed rats as well as in monkeys, and that the adrenal gland is probably concerned in their occurrence[5].

We have now found that the adrenal gland does in fact continue to fluctuate in size in an approximately five day rhythm in spayed rats (Glaxo strain) that are injected daily with the same threshold dose of œstrone. The gland is larger at œstrus than in the dicestrous period, the observations being made on the basis of the difference between the ratios of adrenal weight in grams to body weight in kilograms. The difference between the two means in an equally divided experimental group of 38 rats of similar age and weight was significant, P being less than 0·01.

S. ZUCKERMAN.
G. BOURNE (Beit Memorial Fellow).
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Department of Human Anatomy,
Oxford. Sept. 27.

[1] Zuckerman, S., NATURE, **139**, 628 (1937).
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Toxicity of Mercury Vapour to Insects

A REFERENCE was made in a communication under this title by H. C. Gough in NATURE of May 21, p. 922, to an old Indian custom of placing a small quantity of mercury in a container amongst stored pulses. It seems worth while to direct attention to an analogous belief amongst the Ahoms. A notable feature of the Ahom reign in Assam was the construction of large 'tanks' or open reservoirs of water, of which the surrounding embankment and the level of the water enclosed therein were considerably above the level of the surrounding countryside. Most of these tanks are in existence to-day, one fine specimen near Sibsagar town having a perimeter of more than two miles. The tanks were dug on the site of a spring, the position of the spring within the tank being indicated by a substantial post, and it is said to have been the custom of the Ahoms to bury an earthenware vessel of mercury at the foot of the post and on the site of the spring in the belief that the water would thereby be purified and the tank remain clean and free from undesirable vegetable growths.

We are not aware of any documental evidence for these statements, but they are so well founded in the folk-lore of the people that there seems little reason for doubting at least a substantial basis of truth.

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Cinnamara P.O.,
Assam.

Ninhydrine Reaction in the Quantitative Determination of Different Amino Acids

IN the so-called ninhydrine reaction there is formed, in addition to carbon dioxide, an aldehyde corresponding to the particular amino-acid present. When the reaction is carried out so that the formation of aldehyde is as quantitative as possible, the amino-acid can be determined by the aldehyde. We have made this method quantitative for α-alanine, which gives acetaldehyde[1]. The ninhydrine reaction can also be applied to the quantitative determination of certain other amino-acids. Thus one of us (Laine) has developed the method for the determination of leucine by means of isovaleraldehyde formed in the reaction[2]. We are continuing our work for the determination of other amino acids in the same manner.

The ninhydrine reaction for the determination of the total amino nitrogen has also been improved by us. The reaction must be accomplished at pH 2·2·2, as the ammonium sulphate employed as the condensing substance forms colour with ninhydrine already at pH 2·5 and above that.

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Sept. 8.

[1] *Skand. Archiv Physiol.*, in the Press.
[2] *Suomen Kemistilehti*, B, in the Press.

Energy Levels of the ^{24}Mg Nucleus

USING the cloud chamber method, we[1] have investigated the beta-ray spectra of ^{24}Na. The K.-U. plot showed clearly the existence of two groups. The energy difference between the higher energy group and the lower one is about 1 Mv., their relative intensities being 2, 3 and 1 respectively. The higher energy group lies on the first forbidden Sargent curve, for which $\Delta i = 1$, while the lower one is on the permitted Sargent curve, $\Delta i = 0$.

Kurie and Richardson[2] and Richardson[3] have investigated the gamma-rays emitted by ^{24}Na, their results being as follows:

Energy (Mv.) ..	1·01	2·04	3·00 ± 0·05
Relative intensity ..	1·05	0·95	0·65 ± 20 per cent

We have tried to construct an energy-level scheme of ^{24}Mg which accounts for all the above experimental facts regarding the beta- and gamma-rays. For this purpose we made, besides the energy relations, some plausible assumptions as follows:

(1) In the first place, ^{24}Na is assumed to be in a single energy state because it has only one decay constant, and this nucleus emits two beta-ray groups

resulting in two excited states of ^{24}Mg. These go over either to the ground state or to lower excited states with the emission of gamma-rays.

(2) The change in angular momentum due to the beta-ray emission is $\Delta i = 1$ for the transition corresponding to the higher energy group, $\Delta i = 0$ for the lower one and $\Delta i \geq 3$ for any other transitions.

(3) Moreover, the ground state of ^{24}Mg has zero spin since the nucleus contains $4n$ particles.

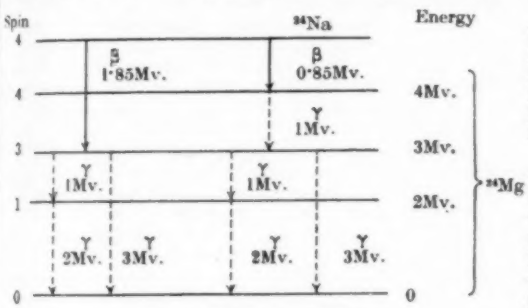
Now, according to Bethe[4], the probability of emission of multipole radiation of order Δi is given by the following formula:

$$\frac{1}{\tau} = \frac{1}{5 \times 10^{-21} (\Delta i\,!)^2 (20/\hbar\omega)^{2\Delta i+1}} \text{ sec.}^{-1},$$

where $\hbar\omega$ is the energy of gamma-rays in Mv. and Δi is the change in angular momentum during the process of emission.

Taking the intensity ratio of the two beta-rays groups into account, we can calculate the relative intensities of the gamma-rays by means of this formula, and compare them with the observed values of Kurie and Richardson.

Of the level schemes which have been studied for the cases having two and three excited states, only the one shown in the accompanying diagram satisfies the observed intensity relations of the gamma-rays.



LEVEL SCHEME OF ^{24}Mg.

The relative intensities of the gamma-rays calculated for this level scheme are as follows:

1 Mv.	2 Mv.	3 Mv.
1·26	0·86	0·52

These figures agree with Kurie and Richardson's values within their limit of experimental error of 20 per cent. All the other level schemes give intensity ratios that deviate greatly from the observed values.

It is probable that there exists some uncertainty in the determination of the intensity ratio of the two beta-ray groups, and the above value (2·3) may be under-estimated. This, however, does not materially affect the above conclusion.

I wish to express my gratitude to Dr. Y. Nishina for his kind guidance throughout the course of this work.

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Aug. 26.

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CN Bands in the Night Sky Spectrum

IN August 1933, at the Pic du Midi, we photographed the spectrum of the night sky simultaneously at the horizon and at the zenith. On each of the four spectrograms so obtained, we noticed that the Vegard-Kaplan bands of molecular nitrogen weaken at the zenith and that new radiations can be distinctly seen in their place. For example, the $(3 \rightarrow 15)$ λ 4531 Vegard-Kaplan band, strong and broad at the horizon, disappears almost completely at the zenith; while, at λλ 4554 and 4576, we observed radiations the intensity of which remained constant. So we were led to draw up a list, including about thirty radiations the intensity of which does not vary obviously from the zenith to the horizon.

The probable presence of the CH bands in the sky spectrum and the analogy of the latter with cometary spectra led us to search in the preceding list for other band-systems associated with carbon. Let us examine the CN case. The 4554 and 4576 sky radiations can be identified with the R and P branches of the $1 \rightarrow 3$ band in the CN violet spectrum. But in order to justify this identification we must find in the list the other CN bands. Indeed we observe the bands of the same sequence: R $(5 \rightarrow 7)$ near λ 4480, R and P $(4 \rightarrow 6)$ near λ 4499, R and P $(3 \rightarrow 5)$ near λ 4517; we notice also the R $(3 \rightarrow 4)$, R $(2 \rightarrow 3)$ and P $(3 \rightarrow 4)$, R and P $(1 \rightarrow 2)$, R and P $(0 \rightarrow 1)$ bands.

In order to go further, we must give up this list, obtained from only four spectrograms and consequently a little brief, and use the tables of wave-lengths which result from all the observations we have made since 1933. Kaplan has already found a good concordance between the wave-lengths given by Gauzit and those of the 'tail' bands[1].

But before considering the bands with high vibrational quantum numbers, it is certainly useful to consider the beginning of the sequences. For the $v' - v'' = -1$ and -2 sequences, we find in the sky: (1) radiations near the origin of the P and R branches; (2) radiations corresponding to rotational quantum numbers near $K = 10$. This distribution is not surprising. In the laboratory, we observe it in presence of active nitrogen; the same distribution was found by Dufay in the comets[2]. In this last case, the maxima correspond precisely to $K = 9$ or 10 when the distance from the sun is one astronomical unit.

It is difficult to go on with a similar attempt at identification for the $v' - v'' = 0$ and $+1$ sequences, for the P and Q branches of the successive bands overlap more and more. Further, we come to a region where the night sky spectrum is imperfectly known.

As to the 'tail' bands, it is interesting to notice that the coincidences observed by Kaplan concern the origin of the bands, although he did not express this precisely. After examination of the structure, we observed also good coincidences with the lines the rotational quantum numbers of which are near 10. These lines are usually the most intense in the laboratory.

Finally, it seems that the bands of the violet cyanogen system are found among the night-sky radiations the intensity of which does not increase obviously from the zenith to the horizon. But among the thirty radiations of the list mentioned at the beginning of this communication, there still remain twenty to identify.

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J. CABANNES.
J. DUFAY.
J. GAUZIT.

[1] Kaplan, J., NATURE, **52**, 1552 (1937).
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Absorption Spectrum of Cobaltous Chloride in Deuterium Oxide

SMALL differences in the colour of solutions of copper sulphate and silver permanganate when dissolved in deuterium oxide instead of ordinary water have been reported by Bell[1], and Hein and Bähr[2] respectively. Displacement of the absorption lines in the spectrum of potassium chrome selenium alum $(KCr(SeO)_4 12\ H_2O)$[3] and of several complex chromium salts[4] when H_2O is replaced by D_2O have also been observed. Bell's work was confirmed by Brodsky and Zanko[5], who made spectrophotometric measurements with copper sulphate in pure H_2O, 43·6 per cent and 92·7 per cent D_2O mixtures.

I have determined the absorption curves of anhydrous cobaltous chloride dissolved in H_2O and 99·6 per cent D_2O. These curves lie within the visible region between the wave-lengths of 4000 A. and 6000 A., and they were obtained by means of a wave-length spectrophotometer. Distinct differences were apparent, the molecular extinction coefficient in D_2O being smaller throughout the region of absorption, and the height of the maximum is lower. The accompanying table indicates the nature of these differences at various points of the curves. Up to 4900 A., the difference is practically insignificant; above 4900 A. it increases and appears to be greatest between 5300 A. and 5400 A., that is, at lower frequencies than the maximum.

Wave-length (A.)	4700	4800	4900	5000	5140	5300	5400	5600
Mol. extinct. coef.								
Solvent, D_2O ..	2·82	3·17	3·46	3·92	4·14	3·30	2·54	1·04
Solvent, H_2O ..	2·89	3·19	3·48	4·02	4·34	3·67	2·84	1·20

These differences are comparable to those obtained by Brodsky and Zanko for copper sulphate.

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Sept. 14.

[1] Bell, NATURE, **137**, 534 (1936).
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Photo-electric Absorption of Radiation in Gases

A LETTER on the above subject by Page[1] and a reply by Menzel[2] have recently appeared in NATURE. While I am in agreement with most of Dr. Menzel's letter, I feel that discrepancies between theory and laboratory experiment in the above field are more radical than his remarks would appear to suggest.

Theoretical calculations are based on the assumption that interactions between neighbouring atoms or molecules may be neglected, so that the atomic absorption coefficient is a true constant, independent of temperature and pressure. Detailed experiments[3] have shown that this assumption is true only at low pressures. The transition-probabilities for the photo-electric process for cæsium, for example, are greatly reduced by the presence of only a few millimetres of the rare gases. Much larger effects are produced by active gases like hydrogen or by the interaction of cæsium with cæsium. It should be emphasized that the continuous state is much more sensitive to these pressure effects than the internal quantized states of the atom. These results indicate that it is not correct to base astrophysical calculations on the assumption that the absorption is proportional to the number of atoms present, except at low pressures. Thus 'atomic absorption coefficients' measured in the laboratory or deduced from one set of stellar data cannot, in general, be used to make calculations on a mass of gas at another temperature and pressure.

Even if we confine ourselves to the region of low pressures, the agreement between theory and experiment is by no means satisfactory. It has been shown that for hydrogen[4] and the alkali metals[5] the absorption should theoretically decrease monotonically from the series-limit in the direction of short wave-lengths. This conclusion is independent of any precise assumption concerning the form of the atomic field[5]. Experiments are available for potassium[6], rubidium[7] and cæsium[8]. For potassium and cæsium the absorption is found to reach a minimum a short distance from the series-limit and then to increase again in the direction of short wave-lengths. (For rubidium, it is probable that the minimum is just at the end of the observed region of the spectrum.)

A second prediction is that there is no discontinuity in the absorption at the series limit. This result has been rigorously calculated for hydrogen[9] and probably applies also to the alkali metals. In a recent paper[10], I have assembled strong experimental evidence which shows that the absorption changes sharply, by a factor of about two, at the series-limit. This discontinuity is found for hydrogen and for all the alkali metals, but for hydrogen its magnitude is probably small.

These discrepancies suggest that the present calculations omit some essential factor, or else that the normalization of the continuous states is not correctly treated. I believe, with Dr. Menzel, that the wave-mechanics will eventually yield a satisfactory theory for this problem. I think, however, that attempts to apply Kramers' formula (or the wave-mechanical modifications of it) to astrophysical problems may be very misleading and certainly must be so at high pressures. At present, it would appear to be necessary to admit that we have no theory of continuous absorption which is satisfactory in the sense of being well verified by terrestrial experiments. While Kramers' formula may be useful as a rough guide, it is safer to regard the opacity as a quantity which cannot be determined theoretically, and, in comparing one system with another, to remember that the atomic absorption coefficient is, in general, a function of the temperature, pressure and state of ionization of the gas surrounding the absorbing atom.

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Sept. 12.

[1] Page, NATURE, **141**, 1137 (1938).
[2] Menzel, NATURE, **142**, 433 (1938).
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Technique of the Painting Process in the Kailasanatha and Vaikunthaperumal Temples at Kanchipuram

THE Kailasanatha and Vaikunthaperumal temples are situated in Kanchipuram, a town forty-five miles west-south-west of Madras by rail. The former was built during the time of the Pallava king, Narasimhavarman II *alias* Rajasimha (A.D. 680–722)[1] and the latter by Nandivarman II *alias* Pallavamalla (A.D. 725–790)[1].

The paintings in these two temples are some of the best specimens of Hindu mural art of the classical or Ajanta school. Those in the Kailasanatha temple are executed on the inner walls of the cells lining the outer walls of the courtyard. But most of them have either disappeared or faded, due to the vicissitudes of time and environment. These paintings probably belong to the seventh–eighth centuries A.D., and were brought to light in 1931 by the French archæologist, Prof. Jouveau Dubreuil of Pondicherry.

The paintings in the Vaikunthaperumal temple, which probably date from the eighth–ninth centuries A.D., are under the eaves and in the niches (*kudus*) of the central tower or the *vimana*. Most of them have disappeared, leaving only a miniature head. But traces of paint are to be seen everywhere on the *vimana*. The paintings in these two temples are older than those in the Brihadisvara temple at Tanjore[2] or in the temple of Vijayalaya Cholesvaram at Narthamalai in the Pudukottah State[3].

As an extension of my studies on Pallava paintings[4] in India, I recently investigated the methods and materials of Pallava artists in these two temples.

The paintings in these two temples are executed on surfaces of sandstone. The painted stucco consists of the *rinzaffo* or the rough coat of lime plaster with fine lime-wash thereon, the latter being applied while the former was still wet. On the lime-wash is a layer of paint film. In the case of some of the paintings in the Kailasanatha temple, there is no rough plaster, and the paintings are executed on the lime-wash directly applied to the sandstone. The thickness of the rough plaster varies with the inequalities of the surface of the sandstone.

The thicknesses of the different layers composing the stucco are :

	Kailasanatha temple	Vaikunthaperumal temple
Painted stucco	2·1–4·3 mm.	3·4–4·7 mm.
Lime-wash	0·3 mm.	0·3 mm.
Paint film	0·3 mm.	0·3 mm.

The results of analyses of the rough plasters are as follows :

	Kailasanatha temple (per cent)	Vaikunthaperumal temple (per cent)
Moisture	1·08	0·17
Carbon dioxide	9·45	21·52
Loss on ignition (excluding moisture and carbon dioxide) ..	5·66	2·66
Silica (SiO_2)	65·37	46·63
Iron and alumina ($Fe_2O_3 + Al_2O_3$)	2·06	1·97
Lime (CaO)	15·71	26·73
Sulphuric anhydride (SO_3) ..	nil	0·15
Magnesia (MgO)	nil	0·04
Undetermined (mostly alkalis)	0·67	0·13
	100·00	100·00

The rough plasters in both the temples have been laid in true fresco technique, and they contain only sand as inert material.

The pigments used in these two temples are the same. Carbon has been used for black, yellow and red ochres for yellow and red, and terre verte for green. The pigments have been applied in lime medium or in fresco-secco technique.

Full details of the investigation will be published elsewhere.

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Aug. 24.

[1] Minakshi, C., "Social Life and Administration under the Pallavas", Chap. viii (Madras University Publication, in the press); for other dates, *vide* Prof. Jouveau Dubreuil, "Ancient History of the Deccan", p. 70 (Pondicherry: Modern Press, 1920).
[2] NATURE, **137**, 867 (1936); *Tech. Studies* (Harvard University), **5**, 221–240 (1937).
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[4] NATURE, **139**, 114 (1937).

The Tetrads in Apoda (Amphibia)

WORKERS on urodelan spermatogenesis have reported the occurrence of large multiple rings in the first maturation divisions of the animals of that group. These multiple rings form the most conspicuous of the tetrads in practically every urodele studied. Multiple ring tetrads in Anura are very rare, and are practically confined to some members of the Discoglossidæ (*Alytes obstetricans* Janssens and Willems[1]: *Bombina pachypus* Galgano[2]: *Bombina orientalis* Sato[3]). Swingle[4] reported such multiple ring tetrads in the male sexual cycle of the tadpoles of *Rana catesbiana* of 40–60 mm. length, while in the second larval sexual cycle of this animal the typical anuran kind of tetrads (simple rings) were present. Swingle, and later Iriki[5], advanced the view that the multiple ring tetrad must be regarded as the ancestral type of tetrad in Amphibia and this view has been further emphasized recently by Sato[3], who has found such compound tetrads in *Bombina orientalis*.

The position of Apoda is very interesting in this respect. It has already been reported[1,6,7] that in *Ichthyophis glutinosus* the larger chromosomes form multiple ring tetrads. In this animal the two large V-shaped and one large rod-shaped pair of chromosomes form during meiosis three compound tetrads. I have recently examined *Uraeotyphlus menoni*, another example of Apoda from South India, and in this form I have found that there are three pairs of large V-shaped chromosomes which form compound tetrads. Whether the view that the multiple ring tetrad is the ancestral type in Amphibia be accepted or not, the resemblance between Urodela and Apoda in this respect is very striking. A full description of the spermatogenesis in *Uraeotyphlus menoni* will be published separately.

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Sept. 10.

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[2] Galgano, M., *Arch. Ital. Anat. Embriol.*, **31**, 1 (1933).
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[4] Swingle, W. W., *J. Expt. Zool.*, **32**, 235 (1921).
[5] Iriki, S., *Sci. Rep. Tokyo Bunrika Daigaku*, Ser. B., **1**, 91 (1932).
[6] Seshachar, B. R., *Z. Zell.*, **27**, 133 (1937).
[7] Seshachar, B. R., *Cytologia*, **8**, 327 (1937).

Prof. Buckland and Oxford

IT may be of interest to note that the verses on Buckland quoted by Prof. J. L. Myres (NATURE, Oct. 8, p. 673) were actually published at Oxford in 1869, in an entertaining little volume entitled "Fugitive Poems connected with Natural History and Physical Science", collected by C. G. B. Daubeny, F.R.S., sometime professor of chemistry and botany in the University of Oxford. They are there dated Dec. 1, 1820, and attributed to Richard Whately, at that time fellow of Oriel, and later Archbishop of Dublin. The verses are reprinted in the "Life and Correspondence of William Buckland" published in 1894, where it is stated that Buckland was so pleased with them that he had copies lithographed to present to his friends.

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THE verses on Buckland appearing in NATURE of October 8, p. 673, were published in "The Life and Correspondence of William Buckland", by his daughter Mrs. Gordon (London, 1894), page 41. It is there stated that they were written by Richard Whately, afterwards Archbishop of Dublin; and that Buckland had them lithographed and gave copies to his friends. The version there printed contains minor variations from that given in NATURE, and is entitled, "Elegy. Intended for Professor Buckland, December 1st 1820". In the same volume there are several other sets of amusing verses on geological subjects.

The verses are also printed in Frank Buckland's "Curiosities of Natural History", Second Series (1903 edit., pp. 144–146).

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Points from Foregoing Letters

FROM a study of the action of strychnine and caffeine upon the critical flicker frequency, Prof. N. T. Fedorov and Lucy Mkrticheva conclude that fusion of light flickers in the synapses of the retina during dark and light adaptation results from the resistance offered by these synapses to the passage of impulses set up in the cones and rods of the retina, so that the impulses undergo deformation and enlargement.

Spectrographic analyses by D. A. Webb show that the presence of strontium gives rise to errors in the estimation of the calcium content of sea water. Since the magnitude of the error varies with the method employed, it is suggested that a conventional interpretation should be given to the term 'calcium content', as is given to the term chlorinity; 'calcium' shall be taken to mean 'calcium after the strontium and barium have been replaced by calcium'.

Dr. L. Havas reports that treatment with dilute solutions of trimethylamine increased the flowers produced by tomato plants and the average weight of tumours produced by *B. tumefaciens*. Also it had effects suggesting sex-hormonal influence upon *Rhodeus*, *Rana* and *Triton*.

Prof. D. Kostoff considers that B. R. Nebel's failure to obtain chromosome doubling by treatment of *Tradescantia* with acenaphthene solution was due to the method employed. The active agent is, he states, the sublimated particles, and he has found acenaphthene crystals to be effective at a distance in producing chromosome doubling in *Nicotiana*, *Triticum* and *Lactuca*.

A table showing the growth-stimulating effect upon oat seedlings of filtrates of various strains of clover nodule bacteria (in presence of tryptophane) is given by H. K. Chen. The non-beneficial strains (which do not lead to nitrogen fixation) appear to be equally effective as growth stimulants.

The adrenal glands in spayed rats injected with œstrone fluctuate in size in an approximately five-day rhythm, according to Dr. S. Zuckerman, Dr. G. Bourne and D. Lewes.

It is stated by W. Wight and P. K. Barua that an account in the folk-lore of Assam indicates that the Ahom tribes used to bury an earthenware vessel of mercury on the site of springs which were feeding reservoirs, in the belief that the water would thereby be purified.

An energy level scheme for the nucleus of nitrogen atoms of mass twenty-four is outlined by A. Sugimoto, to account for the energy and intensity of the beta- and gamma-radiations emitted by sodium atoms of mass twenty-four, from which the magnesium atoms are derived.

A number of cyanogen bands are identified by Prof. J. Cabannes, Prof. J. Dufay and J. Gauzit among radiations recorded in the spectrum of the night sky. These radiations do not change in intensity from the zenith to the horizon and consequently it may be presumed that they have their origin outside the earth's atmosphere.

The molecular extinction coefficient of cobaltous chloride dissolved in deuterium oxide (heavy water) is found by D. C. Martin to be smaller than in water throughout the region of absorption.

In connexion with the use of Kramers' absorption formula in astrophysical calculations, Prof. R. W. Ditchburn points out that the atomic absorption coefficient is in general a function of the temperature, pressure and state of ionization of the gas surrounding the absorbing atom.

S. Paramasivan reports that the Pallava paintings (seventh-ninth centuries A.D.) in the Kailasanatha and Vaikunthaperumal temples at Kanchipuram (South India) have been executed in fresco-secco technique. He gives the results of analysis of the plasters and the pigments. Carbon (for black), yellow and red ochres and terre verte (for green) have been used as pigments.

B. R. Seshachar finds that in the South Indian amphibian *Uraeotyphlus menoni* there are three pairs of large V-shaped chromosomes which form compound tetrads, similar to the large multiple rings observed by other workers in Urodela.

Research Items

Arteries of Peking Man

PROF. FRANZ WEIDENREICH has made a study of the evidence afforded by endrocranial casts of fossil hominids for the character of the meningeal artery, with special reference to its bearing on the phylogenetic problem (*Palæontologia Sinica*, No. 110, N.S.D. No. 3, 1938). It is known that the medial meningeal artery exhibits a rather great variability in recent man with respect to its ramifications. Two main groups are distinguished, of which the second, in which the trunk is divided at a low level into two branches, is the more primitive. In *Sinanthropus* the trunk is as a rule divided into two, or even three branches. There are numerous variations in detail; but the ramifications of all branches, which are rather abundant in recent man, are markedly poor. Little is known of the conditions of the medial meningeal artery in anthropoids or lower apes; but when the gibbon and the great apes are compared with *Sinanthropus* and recent man, it becomes evident that they bear a much closer resemblance to *Sinanthropus* than to recent man. The endocasts of Neanderthal man reveal that *Sinanthropus* is more primitive. Rhodesian man exhibits an instructive example of a mixture of primitive features and a far advanced character; while the peculiarities of the Neanderthal type, so far as known, confirm the conception that it is an intermediate form between *Sinanthropus* and recent man, as supported by the characters of teeth, brain and skeleton. The arterial pattern, in fact, comes close to the more primitive type of recent man. *Pithecanthropus* exhibits a typical hominid pattern similar to advanced *Sinanthropus*, but shows that the classification of *Pithecanthropus* as a gibbon by Dubois is untenable. The pattern of the Piltdown skull conforms in all respects to that of the more advanced type of recent man, while Swanscombe is also typical of recent man. It is evident that the ramifications of the artery in recent man are independent of both size of brain and racial character, but are peculiar to mankind at large.

Boat Processions in Egypt

AMONG the customs of Ancient Egypt which have survived in attenuated form into modern times is that of the boat procession from Karnak to Luxor, in which the god Amun, accompanied by his divine companions Mut and Khons, journeyed up the Nile attended by the Pharaoh and his court. In the opinion of most Egyptologists, this great festival of Opet, of which there is a representation on the walls of the temple of Ramses III at Karnak, survives in shadowy form in the boat processions of Luxor and Qena, held annually on the birthday festival of the Muhammedan patron saint of the towns. The festival and the course of the procession have often been described; but Mr. James Hornell points out in *Man* of September 1938, that the boats which form part of the procession have not received special attention. The procession at Luxor takes place on the fourteenth day of the month Sha'bān, when the participants gather around the gaily-flagged boats in a square adjacent to the mosque of Sheykh el Miqashqash. The two boats are mounted on four-wheeled lorries drawn by men and boys. Each boat is freshly painted, and fitted with a mast, on which is hoisted a blue-striped lateen-sail. Flags inscribed with texts are carried before and after the boats and float from the masts. In build these boats differ completely from the clumsily fashioned craft seen on the Nile. Their lines have a certain dainty elegance. They have clipper bows, long beak-like prows, and an open gallery frame built out beyond the transom stern. Instinctively we feel that in former years, when the festival had more importance than to-day, the boats used were really small replicas of Turkish galleys of the Middle Ages. The nearest related design to these Luxor craft is that typical of the galley-shaped sardine fishing boats now belonging to Malaga, a town held by the Moors until 1487.

Nutritive Value of Pasteurized Milk

Two sets of very similar, though not identical, experiments on the value of pasteurized, as compared with raw, milk for the nutrition of calves have been carried out at the National Institute for Research in Dairying (University of Reading) and the Rowett Research Institute, Bucksburn, Aberdeen, respectively, and the results are published in a joint report (Milk and Nutrition: New Experiments reported to the Milk Nutrition Committee. Part 3: The Effect of Commercial Pasteurization on the Nutritive Value of Milk as Determined by Experiments on Calves. Pp. 27. Shinfield, Reading: National Institute for Research in Dairying, 1938. 2*s*.). In both experiments calves were divided into two similar groups, one group being fed on commercial raw, and the other group on commercially pasteurized milk from the same bulk, with equal small supplements of other foods in the later stages of the experiment. In brief, it may be stated that there was very little difference at the end of the experiment in the weight, growth and general nutrition of the two groups.

Under-water Movements of the Dipper

MANY observers have witnessed the fact that the dipper or water-ousel (*Cinclus cinclus*) can remain and move freely under water; but there has been much speculation as to how a bird, having a specific gravity less than that of water, can remain upon the bottom. It has been suggested that it grips with its toes, but it has been seen walking upon the sandy bed of a stream which afforded no possibility of holding. Dr. J. M. Dewar suggests that in moving water the bird makes its way against the current, at the same time depressing its head and neck, so that part of the force of the current has the effect of pressing it downwards (*British Birds*, **32**, 103; 1938). In still water, the movement of the bird itself creates a current which has a similar effect. By a simple experiment with a block of wood, Dr. Dewar found that the speed of movement (by traction at a suitable angle) necessary to keep the block at the bottom of still water 10 inches deep was equivalent to a rate of only 0·5 mile per hour. More observations are required of the positions actually assumed by the dipper in its submerged movements under different conditions.

Cattle Bot-flies in Norway

IN Norway, as in most European countries, the damage caused to cattle and hides by the presence of bot-flies, *Hypoderma bovis* and *H. lineatum*, was excessive up to about 1920. L. Reinhardt Natvig summarizes the position by stating that in 1922 the loss in England was £15 million, and for England (that is, Great Britain) and its colonies £30 million. Similar heavy losses are given for other countries. In many countries, however, the last twenty years has seen the institution of a vigorous campaign against these insect parasites, which, aided by the discovery of the value of derris in destroying the bots, has had strikingly successful results. Natvig illustrates the effect of the measures taken in Norway by means of two maps, the first showing the distribution and incidence of bots in cattle in South Norway in the years from about 1875 to 1920, and the second showing the same features in 1936 (*Naturen*, **62**, 243; 1938). No evidence could be more convincing of the value of suitable preventive measures firmly and generally applied.

Framework Grafting

AN interesting paper upon the regeneration of fruit trees by W. F. Walker, of Tasmania, has recently been published (*J. Roy. Hort. Soc.*, **63**, Pt. 9; Sept. 1938). Many fruit trees in Tasmania ten years ago were not of the varieties most suited to modern needs. The orchards could, of course, be destroyed and replanted, but several unproductive years would have to be spent. The usual methods of re-grafting and budding were also tried, but most success was obtained with 'framework' grafting. The tree is headed back slightly, but only sufficient to retain the main framework of the branches. Scions are then inserted at intervals of about 8 in. all over the tree. They can be disposed so that they occupy space to the best advantage, whilst future pruning and yield are also under control. Closer spacing results in more fruit spurs, whereas more extended distribution gives greater vegetative growth. Several methods for the quick performance of the grafting operation are described in detail, and the method offers the fascinating possibility of changing the variety without the loss of more than one season's crop. Agricultural success is surely based upon such scientific versatility.

Copper Deficiency in Cultivated Soils

RECLAMATION disease has been known in parts of Northern Europe for some time. It was first recognized as a disease and named by Elema, the name being derived from its frequent occurrence on sandy heaths and moorland soil recently reclaimed. These soils are rich in humus and strongly acid, but it is also found in peaty clay soils; in Denmark it has occurred in *Calluna* heath soils when brought into cultivation. In Holland the reclamation by draining of large areas of waste sandy heath and moorland has met with difficulties from this cause; earlier investigations showed that heavy dressings of urban refuse gave some measure of control; such refuse contains copper salts, and later work has shown that copper sulphate alone was most effective. Liming such soils increased the trouble, presumably lowering the availability of the copper and apparently also removing the small amount of available manganese. Now the observations of C. S. Piper and of D. S. Riceman and C. M. Donald have shown that the 'coastal sickness' attacking grazing sheep in certain coastal areas of South Australia, and the poor crops of cereal obtained from the same soils, similarly yield to treatment with copper salts. Dressings of 28 lb. of copper sulphate to the acre gave much improved yields of wheat, oats and barley, and a new feature is the fact that the original soil in these cases has a very high content of calcium carbonate and a *p*H between 8·5 and 9·0. The same dressing of copper did not effect much improvement on pastures on these soils, but there is evidence that higher dressings of copper or possibly treatments including other elements such as iron, will greatly improve the pasturage. The experimental work with the South Australian soils is described in Pamphlet No. 78 of the Council for Scientific and Industrial Research, Melbourne.

World's Natural Resources

IN a paper on this subject by Mr. F. E. Lathe read at the June meeting of the American Association for the Advancement of Science in a series of communications on "Science and Society", an attempt is made to reach a quantitative estimate of the world's resources in food, power and minerals. The conclusions are that, with the continued applications of science, food supplies will suffice for a population of four times the present numbers, and that in power and most of the minerals of value to man there is little cause for anxiety. This is true, however, only when the world is considered as a single economic unit. For the large number of units, most of which are striving for economic self sufficiency, the outlook is very different. In order to illustrate the extreme mutual dependence of nations, Mr. Lathe has compiled a table showing the extent of national sufficiency of the seven great powers of the world in coal, iron, copper, lead, zinc, nickel, tin, asbestos and petroleum. Ascending numerical order shows decreasing sufficiency for national needs in each commodity. The table shows that only the British Empire, the United States and the U.S.S.R. are each self-sufficient in half or more than half these substances; but that no other power reaches that level in more than one commodity and several in no commodity. Thus he illustrates his theme that international trade is essential and self-sufficiency an economic fallacy.

Antarctica and the Glacial Ages

THE Antarctic ice-sheet in Pleistocene times, which has recently been under discussion in the correspondence columns of NATURE (see Sept. 3, p. 438), enters into the argument of a consideration by Prof. F. E. Zeuner of the chronology of Pleistocene sea-levels (*Ann. and Mag. Nat. Hist.*, Ser. 11, **1**; 1938), though the evidence taken into account concerns volume rather than extent. Prof. Zeuner compares actual conditions of sea-levels observed in the Mediterranean in the work of A. C. Blanc with those postulated on the basis of the 'glacial control' theory and the curves of solar radiation as calculated by M. Milankovitch in 1930, which have been found to reproduce correctly and in detail the fluctuations in the extension of the ice during the Pleistocene age. As a result of his comparison, Prof. Zeuner finds that the observable climatic phases and changes of sea-level in the Mediterranean agree completely with the fluctuations postulated on the basis of the curve of radiation. In the course of his computation, he

has occasion to observe that the Pleistocene sea-levels appear to be related to the glacial phases of the northern hemisphere only. This conclusion is based on his view that at no time did the increase in the volume of ice in the Antarctic, as compared with present conditions, ever exceed one third of the present volume. Taking W. B. Wright's figures of approximately twelve million cubic kilometres as the present volume, this would give in the most intense phase, that is, according to Milankovitch's figures of the solar radiation curve, the first phase of the last glaciation, Würm I, an approximate maximum volume of 16 million cubic kilometres, whereas R. A. Daly's calculation for the Scandinavian ice cap of the last glaciation is approximately five million cubic kilometres, the variation in the antarctic sheet being put at four to six million cubic kilometres at most, as against a deglaciation of the north American, European and Siberian ice-caps of 35 million cubic kilometres since the maximum.

Nickel Carbonyl

IN 1931 Pauling (*J. Amer. Chem. Soc.*, **53**, 1367; 1931) showed that, on the theory of directed valency, nickel carbonyl ($Ni(CO)_4$) should have a tetrahedral structure. In 1934, the Raman spectrum appeared to indicate a square configuration. In the following year, electron diffraction studies pointed to the tetrahedral structure, but the observed nickel-carbon distances suggested that resonance occurred with some structure (probably the square configuration) having nickel-carbon double bonds. Recently Bailey and Gordon (*J. Chem. Phys.*, **6**, 225; 1938) and Crawford and Cross (*ibid.*, **6**, 525; 1938) have measured its infra-red spectrum and their results are in satisfactory agreement. In the later paper the data, obtained for liquid $Ni(CO)_4$ from 1μ to 8μ and for $Ni(CO)_4$ vapour from 1μ to 23μ, are analysed in conjunction with Raman spectral data, and indicate that the molecule has a tetrahedral structure, although the square configuration is not completely excluded. By the methods of group theory, normal co-ordinates, selection rules, and spectroscopic characteristics of both models have been derived, and the calculated values of fundamental frequencies, first overtones, and binary combination tones are compared with the observed results. Further, evaluation of the force constants show that that for carbon-oxygen stretching has a value intermediate between those for $C = O$ and $C \equiv O$ bonds. Interatomic distances, derived from force constants, agree with recorded values.

Lighting in Mines

THE Mines Department has been co-operating with the manufacturers of safety lamps and lamp bulbs and with other associations with the object of assisting the industry. The Secretary for Mines has published a circular (M.D. No. 115) giving an account of the directions in which progress is being made. A most important development is in connexion with lamp bulbs. It is found that the argon now commonly used for lamp bulbs can be replaced advantageously by krypton. Recent investigations show that a higher lighting efficiency is obtained without any reduction in the life of the bulb or any increase in its current consumption. The tests made at the Mines Department Testing Station on krypton-filled bulbs show increases of 20–30 per cent in lighting efficiency as compared with argon-filled bulbs of the same rating and life. The arrangements already in use for testing the performance of 'approved' bulbs will be applied to krypton-filled bulbs, and collieries can therefore rely on the maintenance of the improved results obtained in the tests. The use of these bulbs, which are slightly smaller in diameter than ordinary bulbs, does not entail any alteration in the construction of the lamps or batteries, but as krypton is more expensive the bulbs are 2½*d.* dearer. The Secretary of Mines considers that owing to the high efficiency of the lamps the cost will be less for a given illumination. When the British Standards Institution undertook to specify the requirements for miners' lamp bulbs, it was necessary to fix the life of the lamp. This was fixed at 600 hours, but it was found in practice that the actual working life was longer than this. The B.S.I. has now reduced the laboratory test of 600 hours to 500 hours as this greatly improves the efficiency. Attention is also directed to a new type of mercury vapour bulb for lamps fixed in position which works at the low pressure of 100 volts and gives high efficiency and a long life.

Measurement of Powdered Materials

THE methods at present available for measuring the fineness of powdered materials used in engineering and industrial processes are described in detail in a paper submitted to the Institution of Mechanical Engineers by Dr. Harold Heywood, senior research officer of the British Coal Utilization Research Association. In it, definitions of particle size and shape are discussed and examples are given by means of typical size-distribution curves for granular and powdered materials such as moulding loam, pulverized coal, Portland cement, and mine atmospheric dusts. For the size grading of comparatively coarse powders the method of sieving or screening is used, and the author explains and elucidates the theory of sieving and the relationship between particle size and sieve aperture. Differences in materials due to density, particle shape, stickiness, hygroscopicity, etc., have made it impossible to devise a general sieving specification and, as the process cannot, in general, be carried to completion, the usual practice is to specify an end-point either by limiting the time of sieving or by continuing the operation until the weight passing the sieve in a given time is a stated percentage of the original sample or of the residue on the sieve. The first is an easy test to apply, and, in the case of a particular material not likely to vary much in fineness, provides a useful test. The last is more sound fundamentally but is difficult to apply. In the grading of particles of sub-sieve size, the processes used involve motion in a fluid. Dr. Heywood discusses the motion of such particles and gives a method by which their falling velocity can be calculated when the fluid flow around them is turbulent. He describes several processes which are employed in this form of analysis and explains their respective merits and advantages, including in his survey elutriation by means of air or water, sedimentation, hydrometry and the obscuring of a beam of light by dilute suspensions. Reference is also made to a device developed at the Fuel Research Station for comparing the fineness of viscous suspensions such as coal-oil mixtures for boiler firing, and consisting of a test-tube containing the mixture and pivoted slightly above its centre of gravity. This is made to oscillate, and the changing time of oscillation as the powder sinks provides the means of determining the rate of settling.

Seventh International Management Congress

THE Seventh International Management Congress was held in Washington, D.C., in September last. According to a leaflet, issued to prospective members, a feature of the Congress was to be "the presentation of both American and foreign points of view on the most important aspects of management in relation to social and economic problems".

More than twenty countries sent delegates to the conference, the most notable exception being Soviet Russia, the absence of delegates from which may be regretted since a socialist State has many interesting management problems of its own. Business men were in a majority among the delegates, although there were also many research workers and university representatives, largely from the United States. This is, in itself, an interesting indication of the rapid development of the social sciences in the United States and their contact with the world of production and distribution, and management in general.

More than two hundred papers were presented to the Congress for discussion, covering the fields of administration, production, distribution, personnel, agriculture, and home management. But a great deal of this material was nothing more than propaganda for or against various political regimes. There was much that might have been better said and even more that would have been better not said at all; though one must concede that many of the contributors may have been misled by the terms of reference which have been quoted.

It would have been well if more of the delegates had written their papers and speeches from the point of view so ably expressed by Lord Leverhulme in an address to the Congress. "We are all conscious," he said, "of the striking disparity between the world's actual consumption of goods and services and the potential powers of production with which science has now endowed mankind. Few of us, on the other hand, accept this situation as the natural and permanent result of the progressive application of science to all departments of our life and culture. We recognize our present troubles to have arisen to a large extent because our progress has been unbalanced and there has been a time lag between technological progress and progress in other departments of human endeavour. We recognize that the danger of our present situation lies not in the increasing impact of science on our lives, but in the uneven incidence of this impact. While productive efficiency has increased and continues to advance with bewildering rapidity, we destroy much of the possible advantage to be derived from this progress by the methods we adopt in our distributive machinery and in our dealings with our fellow men. As long as we continue to believe that the problem must be solved by the artificial creation of scarcity through restricting production, so long will the situation continue to grow worse."

The reason why the above approach to management problems was largely absent from the Congress was best expressed by Dr. H. C. Link in an excellent speech on the psychological foundations of management. "A few weeks ago", he said, "the steel companies announced their annual appropriations of about ten million dollars for research into the development and behaviour of steel. This is more in one year than has been spent in the entire history of psychology, since it became a quantitative science, for research into the development and behaviour of personality. . . . What are the results? One of the most obvious is this; while denying the possibilities of a science of man, almost every manager regards himself as an authority on human nature. Managers who consider themselves ignorant of the dynamics of machines nevertheless consider themselves, with no more scientific study, authorities on the dynamics of the emotions of man. The result has been a continuous conflict of personal opinions, and the triumph of might rather than right, of expediency rather than truth."

It can be very easily understood from this, that a management conference is handicapped by the fact that there is so little concrete data to talk about and discuss, and wherever such a state of affairs exists there are bound to be numerous papers about nothing at all. A great deal of the general addresses were nothing more than orations on the merits of private enterprise, re-echoing, time and time again, old, familiar, and outworn phrases. In view of the fact that the Congress included delegates from the co-operatives of many countries and also from labour organizations, such speeches were thoroughly misplaced, and although the delegates listened with good humour, many of them must have felt that they indicated the presence of a terrible number of guilty consciences. But in spite of this, it was encouraging to find quite a few of the delegates expressing the view that managerial problems ought to be studied strictly from the professional aspects, and that their study is obscured by political contentions, selfish motives and class conflicts. A plea from Major Urwick that management problems should be approached from the scientific rather than from the nationalistic attitude was passed by without much consideration.

On the whole, it may be said that neither the papers presented at the general sessions nor the subsequent discussion were particularly noteworthy. Some of the papers dealt with management problems, but the majority were concerned only with technological procedures. The agricultural section, which stood in a class by itself in so far as quality was concerned, discussed a total of thirty-seven papers, of which seventeen dealt with purely technical matters such as the control of plant diseases, soil erosion, etc. Prof. John D. Black in some concluding remarks to this section said that "it is not difficult for one who has had contact with our agricultural colleges to understand how management in agriculture has come to be discussed in this segmentary way. . . . No satisfactory co-ordination of technology and social science has been achieved."

With regard to the other sections, very little can be said. The distributors spent three days discussing problems such as sales promotions, touch appeal, branded goods, and, more often still, arguing about the meaning of the terms they were using. The consumer was in the forefront of all such debates, though he was talked about more as a victim than

as one who is to be served. The Swedish co-operators, who had much to contribute to the general theme of improving on our present methods of distribution, as also some of the other foreign visitors, were given little opportunity or encouragement to take an active part in the discussions.

Similar remarks could be made about the other sections.

During the meeting "The American Society for the Advancement of Management" held a dinner for those attending the Congress, at which various New Deal administrators were invited to speak. This was the only occasion during the week at which the New Deal was mentioned, other than in derogatory terms. From the point of view of the visitors from overseas, this was the most instructive meeting, for here alone was it possible to learn about things which they did not understand, and to hear things which had been heard many times before.

R. M. W. TRAVERS.

Research and Development in Glass Technology

New Laboratories at St. Helens

THE new research laboratories of Messrs. Pilkington Brothers, Ltd., at St. Helens, opened by Sir William Bragg on October 5, represent a yet further stage in the scientific development of glass technology in which such striking progress has been made during the post-War years. At the luncheon before the opening ceremony, Lord Cozens-Hardy, chairman of the company, reviewed its progress; the firm has carried out glass manufacture at St. Helens for more than a century, the first works chemist having been appointed in 1844 and the analytical laboratory dating from 1869. He referred to the high level of glass making which had been attained by chemical and technical skill in the early years of the century. Not only was it known what types of ingredients and proportions were necessary to obtain high-quality glass, but also very considerable strides had been made in manufacturing refractories to stand up well to high-temperature conditions without being unduly attacked by the molten glass. Since the Great War, however, the manufacture of glass has largely been mechanized, necessitating very close control of the compositions and the temperature at which glass is melted and worked. Out of the experimental investigations necessitated by this position there has grown a technical development department.

Towards the end of 1936, the directors of Messrs. Pilkington Brothers decided to supplement this work by forming a research laboratory, closely associated with which was to be a general analytical laboratory for control of the Company's products. The new research department is intended to function in the more academic field of science and will, it is expected, frequently be responsible for fundamental work on first principles. The problems with which the new laboratories will be confronted fall into seven categories, covering the melting of glass, the study of refractories, the processing of glass, uses of glass, the properties of glass, methods of testing glass, and miscellaneous matters such as the production of mirrors to withstand rigorous weathering and temperature conditions, etc. Lord Cozens-Hardy referred to further advances in glass manufacture which are approaching completion, by which a ribbon of glass flowing out of a tank is passed successively through the annealing process and through a grinding and polishing machine which treats both sides simultaneously, the whole machine being more than 1,000 feet long. Its use, it is believed, will once more completely revolutionize the manufacture of plate glass.

Before cutting a glass silk ribbon across the doorway of the new laboratory, Sir William Bragg referred to the way in which in recent years the use of X-ray methods has elucidated the ultimate structure of glass with some approach to completion. The remarkable net-like structure thus revealed has laid the foundation for a wholly new attempt to relate the physical and other properties of glass with its chemical constitution. This fuller understanding of the constitution of glass has led to further control over manufacturing methods.

The new laboratories have been built to the design of Mr. Herbert J. Rowse, who also designed the United Kingdom Government Pavilion at the Glasgow Exhibition. Together with the equipment, the cost of the new laboratories is about £40,000, and they are designed to house the director of research, Dr. H. Moore, and a staff of forty-seven, including fifteen to twenty university graduates and about twenty-five qualified technical assistants. The laboratories are designed essentially to meet individual requirements, and a novel feature is the use of glass bricks for the internal corridor walls. Most of the physical laboratories are devoted to special instruments or special testing processes, and they include an X-ray laboratory with a fully automatic X-ray apparatus for the identification of crystals and the determination of the viscosity of glass. Other laboratories are specially equipped for thermal expansion measurements, the determination of refractive index and hardness, the measurement of the bending of loaded glass beams, flatness testing and optical work. Among the equipment of the latter is a photometer head integrating sphere for measuring the transmission of light through opaque glass and a Babinet strain viewer. An annexe to the laboratory is devoted to high-temperature work on refractories, glass melting and toughening. Among the apparatus exhibited was a stirring test designed by a member of the staff for comparing the merits of different materials for the construction of tank surfaces. In this apparatus five fingers of these various materials, fixed into a flat circular plate, are rotated vertically in a bath of molten glass at 1,500°.

The main block of the research laboratories includes a large analytical laboratory and laboratories for general chemical research and organic research. In

addition, the building includes a library, the furniture for which was made in Messrs. Pilkington Brothers own carpentry and cabinet-making shops. The library already contains a nucleus of about 2,000 books, including a number of the earliest records of the firm dating from 1869. A number of striking examples of coloured glasses and fluorescent glass were shown in the laboratories. Both the exhibits and the equipment of the laboratories fully justified Sir William Bragg's remarks as to the national importance of the inauguration of this new research institution.

Fifth International Congress for Applied Mechanics

THE Fourth International Congress for Applied Mechanics was held at Cambridge, England, in 1934, and the Fifth very appropriately met at Cambridge, Massachusetts, on September 12–16. The Congress was attended by more than four hundred members as the guests of Harvard University and the Massachusetts Institute of Technology. More delightful hosts could not have been desired by the members who shared in the meetings and in the entertainments arranged by the local committee consisting of H. M. Westergaard, J. P. Den Hartog, J. C. Hunsaker, L. S. Marks and H. Peters.

The Congress was opened by Prof. K. T. Compton, president of the M.I.T., acting as president of the Congress. The work of the Congress was accomplished by means of technical sessions at which communications from members were read, by general lectures, and by a symposium on turbulence. The field of applied mechanics was divided into the following general heads: (I) Structures, elasticity, plasticity, fatigue, strength theory, crystal structure. (II) Hydro and aerodynamics, gas-dynamics, hydraulics, meteorology, water waves, heat transfer. (III) Dynamics of solids, vibration and sound, friction and lubrication, wear and seizure. Simultaneous sessions of the three sections were held. Abstracts of the papers presented were printed in English in the September issue of the *Journal of Applied Mechanics*, a copy of which was given to each member. Communications were received from the following workers from the British Empire: S. Brodetsky, L. P. Coombes, J. N. Goodier, A. A. Hall, C. E. Inglis, G. J. Klein, L. M. Milne-Thomson, E. F. Relf, F. G. Richardson, D. M. Smith, A. V. Stephens, J. L. Synge, and G. I. Taylor, who gave a general lecture on turbulence. The meetings were held at the M.I.T. for the first four days, and on the last day at Harvard University.

On Monday, September 12, members were able to be present at the dedication at the M.I.T. of the Wright Brothers Wind Tunnel, among the speakers at the opening ceremony being G. Brewer, of the Royal Aeronautical Society. The tunnel is a closed welded cylindrical steel circuit, with a 2,000 h.p. electric-motor and a variable pitch propeller, in which the air can be compressed to four atmospheres giving a Reynolds' number of 6,500,000, or exhausted to one quarter of an atmosphere, when a velocity of 400 miles per hour is expected to be attained. The working section of this remarkable tunnel is an ellipse, ten feet by seven and a half feet.

Apart from attending lectures and hearing papers read, one of the great advantages of an international Congress is the opportunity of scientific workers from different countries meeting personally and exchanging ideas in a quite informal fashion. This opportunity was amply afforded by the receptions and conversaziones which were organized for each evening and contributed in no small measure to the success of the meetings. The largest social undertaking, apart from the final dinner, was the excursion on Thursday, September 15, to Middlesex School, the route passing through Lexington and Concord, places famous in American history. At the School a picnic supper was served, an address on Galileo's "Discorsi" was given by Dean S. H. Hollister, of Cornell University, and the proceedings were thereafter enlivened by a bonfire and a male chorus of Boston Negroes.

Following the Congress, members were invited to visit the National Bureau of Standards at Washington, D.C., and the aeronautical laboratory at Langley Field, Virginia. Many members availed themselves of this opportunity of seeing important scientific work in progress, and some very pleasant parts of the United States.

New Laboratories of the Metropolitan Water Board

NEW Laboratories of the Metropolitan Water Board were opened by the Minister of Health, the Right Hon. Walter Elliot, M.P., on October 17 in the presence of a distinguished company. They are situated at New River Head, Rosebery Avenue, adjacent to the Board's head offices, and replace laboratories in Nottingham Place, which have been in use since 1905.

The Metropolis Water Act of 1871 provided for the appointment of a 'water examiner' by the Board of Trade, and in early days the water supplied by the London water companies was subjected to daily examination by Sir William Crookes and Profs. James Dewar and Percy Frankland. Under the Metropolitan Water Act, 1902, by which the several existing water companies were consolidated into one undertaking under the newly constituted Metropolitan Water Board, the Board was similarly placed under an obligation to conduct chemical and bacteriological examinations of its water.

The Board in 1905 appointed the late Sir Alexander Houston to be "Director of Water Examinations";

he died in 1933 and was succeeded by the late Lieut.-Colonel Harold. In 1936, the Board approved a scheme for the erection of new laboratories, and Colonel Harold and the appointed architect, Mr. Murray Easton, visited many laboratories in the United States in order to ascertain the latest developments in modern laboratory planning and practice. The present building is the outcome of their inquiries, but unfortunately Colonel Harold did not live to see its completion. A descriptive booklet has been issued in connexion with the opening, which contains views of the new building and of some of the laboratory interiors.

The new laboratory block has a north-south aspect and is built on a curved plan, the object of which was to allow more open space around, and to relate it to the existing head office block, so that in case of extension the quadrant would strike the end of that building. This construction not only produces a striking appearance architecturally, but also provides some thirty feet more space for the rooms facing north.

The basement contains store rooms, cold, cool biological, and spare laboratories, cold room and refrigerating plant, air conditioning plant, motors, centrifuge and boiler room, and workshop. The director's room is on the ground floor, with offices, library, photomicrographic room, biological, biochemical and bacteriological research laboratories. The first floor houses wash rooms for apparatus, preparation and sterilizing rooms for culture media, the bacteriological laboratory and sub-culture rooms, and four constant-temperature rooms for incubation. All the top floor accommodation faces north and is allotted to the chemical section, with rooms for distillation, balances, stills and fume cupboards.

The building is of brick with stone facings, and is steel framed. Rubber flooring is used for most of the laboratories, and laboratory benches are in teak. Vacuum and compressed air points are provided on the benches, also steam where required. Access to the various floors is provided by a lift and a circular staircase housed at the east end in a circular tower-like extension. Full details respecting construction, fittings and general lay-out are given in the booklet referred to above.

University Events

BOMBAY.—Dr. K. Venkataraman, reader in dyeing and printing, has been appointed Mody professor and head of the Department of Chemical Technology in succession to Prof. R. B. Forster.

CAMBRIDGE.—The following appointments have recently been made: Dr. R. H. Thouless, of Corpus Christi College, University lecturer in education; Dr. J. T. Irving, of Gonville and Caius College, University lecturer in physiology; F. R. Berridge, of Trinity College, assistant in research in radiology (diagnostic); Dr. A. Paterson, of the University of Edinburgh, assistant in research in psychiatry.

The Research Committee of the Dyestuffs Group of Imperial Chemical Industries, Limited, has offered a research studentship to the University when the Company requires to encourage research of a particular subject. The stipend will be £350 for two years, with a possible extension, the appointment to be made by the University, after advertisement if desired.

A. R. H. Trim, of Trinity College, has been elected to the B. W. Levy studentship in biochemistry.

Dr. H. G. Sanders, University lecturer in agriculture, has been elected into a fellowship at St. John's College.

R. Howles, of St. John's College, has been appointed to the Frank Smart studentship in botany.

At Trinity College the following have been elected into fellowships: Dr. S. A. H. Rushton, Michael Foster student, 1925, Stokes student, 1927, Gedge prize, 1928, research fellow of Emmanuel College, 1930, University lecturer in physiology. D. J. Bauer, for research in physiology; Mr. Bauer gained a double first in the Natural Sciences Tripos and was Michael Foster student in 1937–38. E. R. Love, for research in mathematics; Mr. Love was a senior optime in Part II of the Mathematical Tripos and gained honours, with distinction, in Part III; he was Smith's prizeman in 1937. W. C. Price, for research in physical chemistry.

The Managers give notice that an election to the Pinsent-Darwin studentship in mental pathology will be made in January 1939. The studentship is of the annual value of not less than £225 and is tenable for three years. The student must engage in original research into any problem having a bearing on mental defects, diseases or disorders, but may carry on educational or other work concurrently. Further information can be obtained from the Secretary, Pinsent-Darwin Studentship, Psychological Laboratory, Cambridge.

LONDON.—The appeal for an endowment fund of £100,000, which was launched a year ago on behalf of the Department of Business Administration, at the London School of Economics in the University of London, has not yet achieved its full objects. It had been hoped to raise a sum, the income from which would not only make the finances of the Department permanently secure, but would also enable it to carry out several much-needed developments. Further donations are urgently needed in order to achieve fully the purposes of the appeal. The amounts so far subscribed will nevertheless be sufficient to ensure the maintenance of the Department on its existing scale for a further period of seven years; and university students who contemplate a business career and wish to devote a post-graduate year to special training, may plan their studies in full confidence that the course will continue to offer at least the same facilities as hitherto.

SHEFFIELD.—The following appointments have recently been made: Dr. G. C. Hampson, assistant lecturer in chemistry; J. C. Colman, assistant lecturer in zoology; E. Baildon, assistant lecturer in mechanical engineering.

The Council has received a notification of a bequest, free from legacy duty, under the will of the late Mrs. Lucy H. Habershon, in the following terms: "To the University of Sheffield any of my late husband's books on mining or kindred subjects which they may care to have and the sum of Three thousand Pounds for the purpose of founding or establishing a fund to provide Scholarships in Mining to be called 'The Matthew Henry Habershon Scholarships', and a further sum of One thousand Pounds for coal dust research work."

Mr. M. H. Evans has resigned his post of lecturer in physics, and Dr. E. Seddon his post of lecturer in glass technology and research physicist.

Science News a Century Ago

The Zoological Society

AT a meeting of the Zoological Society on October 23, 1838, letters from three corresponding members were read. M. Julian Desjardins, secretary of the Natural History Society of Mauritius, wrote saying that it was his intention to leave that island on January 1 of the following year for England, with a large collection of objects on natural history, many of which he intended for the Society; Colonel P. Campbell wrote from Alexandria that he had not yet succeeded in gaining any further information respecting the possibility of procuring some white elephants for the menagerie in Regent's Park, and Lieut.-Colonel Doherty, governor of Sierra Leone, wrote that he was using every exertion to procure for the Society a male and female chimpanzee.

Statue of Watt at Greenock

"THE statue of James Watt, by Sir Francis Chantrey, is now placed in the building erected for it in Union-street. It is an 8 feet figure, of statuary marble, and weighs upwards of 2 tons, and the pedestal, which is of Sicilian marble, weighs about 3 tons. On the front of the pedestal is the following inscription, from the classic pen of Lord Jeffrey: 'The inhabitants of Greenock have erected this statue to James Watt, not to extend a fame already identified with the miracles of steam, but to testify the pride and reverence with which he is remembered in the place of his nativity, and their deep sense of the great benefits his genius has conferred on mankind. Born XIX January MDCCXXXVI. Died at Heathfield in Staffordshire, August XXV, MDCCCXIX'. On the right of the pedestal is a shield containing the Arms of Greenock, and on the left strength and speed." (*Mechanics' Magazine*, October 27, 1838.)

Airy's Compass Experiments

THROUGHOUT 1838, the Astronomer Royal, Airy, was much occupied with the improvement of compasses for iron ships, and, at the instigation of the Admiralty, in the summer made experiments in the steamer *Rainbow*. On October 5 he received an application from the owner of the iron sailing ship *Ironsides* to correct her compasses. He accordingly went to Liverpool where he, as he said, "made a very important improvement in the practical mode of performing the correction". On October 28 he wrote to his wife referring to the *Ironsides*: "I worked up the observations so much as to see that the compass disturbance is not so great as in the 'Rainbow' (35° instead of 50°), but quite enough to make the vessel worthless; and that it is quite different in direction from that in the 'Rainbow'—so that if they had stolen one of the 'Rainbow' correctors and put it into this ship it would have been worse than before." Again, on November 1, he wrote, "On Wednesday I again went to the ship and tried small alterations in the correctors: I am confident now that the thing is very near, but we are most abominably baffled by the sluggishness of the compass". Airy reported on his experiments to the Admiralty and on December 4 had an interview with Lord Minto, the First Lord of the Admiralty, and Mr. Wood (afterwards Lord Halifax), the secretary, but "they refused to sanction any reward to me". His experiments, however, led to a great extension in the building of iron vessels.

Societies and Academies

Paris

Academy of Sciences (*C.R.*, **207**, 437–456, August 29, 1938).

H. LEBESGUE: Equivalence of regular polyhedra.

P. LEJAY: Method of calculation of the coefficients characterizing atmospheric obscurity. Variations of this obscurity in the neighbourhood of Shanghai.

A. ROSENBLATT: Series of univalent powers in the circle of unity.

P. LÉVY: Addition of definite aleatory variables of modulus one.

L. I. GAMA: Additivity of the *accumulatif*.

H. BIZETTE, C. F. SQUIRE and B. TSAÏ: The transition point λ of the magnetic susceptibility of manganous oxide. Curves are given for the susceptibility at 7,000 gauss and 24,000 gauss from about 40° K. to ordinary temperature.

MLLE. M.-L. ALLAIS: New measurements of the *K* spectra of arsenic (33), selenium (34) and bromine (35).

A. DAUVILLIER: The internal structure of the globe, and the genesis of the continents and oceans. An outline of a hypothesis, a feature of which is that the globe, while still incandescent, had five lunar seas which became the basins of the oceans. The atmosphere consisted of hydrogen and helium, and as the temperature decreased, the former reduced metallic oxides of the sial and formed water which eventually condensed and eroded away the lunar relief.

E. LEDERER and MLLE. R. GLASER: Echinochrome and spinochrome. The former, a red pigment from the blood corpuscles of a sea-urchin, has been obtained in crystalline form; while the latter, from the violet spines of a sea-urchin, is formed from it by the substitution of a hydroxyl group for a hydrogen atom.

(*C.R.*, **207**, 457–468, Sept. 5, 1938).

K. MENGER: New basis for the development of the geometry of Bolyai and Lobatchefski.

R. WAVRE: A method of Volterra and a theorem of Dive relating to fluid masses.

S. NIKITINE: Experimental study of the photodichroism of cyanine.

J. GAUTRELET and MLLE. E. CORTEGGIANI: Liberation of acetylcholine from the acetylcholine complex of mammalian brain by cobra venom.

G. RAMON, A. BOIVIN and R. RICHOU: Obtaining staphylococcal toxin and anatoxin in a medium of definite chemical composition. The medium does not contain peptone.

(*C.R.*, **207**, 469–480, Sept. 12, 1938).

R. SALEM: Convergence of Fourier series.

F. LEJA: Approximation of continuous functions by certain harmonic functions.

R. DALMON: Study of the constitution of nitric acid by its absorption spectra.

H. GAULT and E. STECKL: Research on the condensation of acyclic aldehydes with certain compounds containing the carbonyl group. Condensation of formaldehyde and acetaldehyde with cyclohexanone.

MLLE. M. FOURCROY: In *Pinus pinea* each convergent conserves its functional individuality during reduction.

(*C.R.*, **207**, 481–508, Sept. 19, 1938).

S. G. WAKSMAN and J. W. FOSTER: Effect of zinc on the plant body of *Rhizopus nigricans*, and the production of acid by that organism. In the nutrition of this organism, zinc acts as a catalyst for the production of fumaric acid.

E. BATSCHELET: Hypothesis of M. E. Lasker relating to polynomial ideals.

P. GILLIS: Equations of Haar relative to the calculus of variations.

G.-A. BOUTRY and R. ZOUCKERMANN: Use of dry [copper-copper oxide] rectifier for the production of continuous high tension [current]. An apparatus giving 10 milliamperes at 100,000 volts and utilizing this principle has been constructed. A similar machine giving the same current at 500,000 volts is under construction.

R. TREMBLOT: The quadruple star 59 Serpent. This star is usually regarded as a visual binary; spectrograms recently obtained suggest that it is a quadruple star.

R. DE MALLEMANN and F. SUHNER: Magnetic rotatory power of hydrofluoric acid.

M. ROSSIGNOL and A. RIBOULLEAU: Action of resorcinol on the bichlorhydrates of the quinine alkaloids.

A. BOUTILLIER: Irregular dilatometric anomalies in the copper aluminium alloys in the region of 12 to 100 aluminium.

J. VIRET: Age of the lignitic clays of Nassiet, near Amou (Landes).

G. DUBOIS and MLLE. C. DUBOIS: Some peat beds of Haute Tarentaise.

D. LEROUX: Influence of time and variations of temperature on the content of agricultural soils of water-soluble fertilizing principles.

G. BRONSTEIN: Mechanism of the formation of the polyp of *Membranipora membranacea* L.

Brussels

Royal Academy (*Bull. Classe Sci.*, **24**, Nos. 6–7, 1938).

C. DE LA VALLÉE POUSSIN: Irregular points. Determination of masses from potentials.

L. GODEAUX: Unit points of the second kind of cyclic involutions belonging to an algebraic variety.

O. DONY-HÉNAULT: Discovery of the thermal metallurgy of zinc in Belgium at the beginning of the nineteenth century. Forgotten documents.

V. WILLEM: Respiratory movements of the frog. A refutation of the conclusions of C. P. Gnanamuthu.

E. DE WILDEMAN: Movements during their development of certain organs of higher plants.

M. BRELOT: Subharmonic functions and balayage.

P. DEFRISE: Curves possessing a hyper-elliptic, cyclic involution without multiple points.

A. FESTRAETS: Stroobant's star stream.

R. COUTREZ: Dynamics of spiral nebulæ.

R. DEFAY: Two aspects of the second law of thermodynamics in systems having a non-uniform temperature (1) and (2).

G. PETIAU: Eigen functions of the fundamental operators of Dirac's theory of the electron.

J. BRACHET: Localization of proteins containing the sulphhydryl group during growth of amphibians.

R. VANDENDRIES: Homothallism in *Octojuga*.

L. DERWIDUÉ: Fundamental elements of the birational transformations in four-dimensional space.

Z. M. BACQ: Distribution of acetylcholine in the potato plant.

Cape Town

Royal Society of South Africa, August 17.

P. W. LAIDLER: The morphology and classification of ground and polished stone artefacts of South African origin.

J. C. MIDDLETON SHAW: Growth changes and variations in wart-hog third molars, and their palæontological importance.

H. ZWARENSTEIN: Seasonal variations in sensitivity to progesterone-induced ovulation.

H. A. SHAPIRO: The biological standardization of certain steroids. (1) Seasonal changes in response of *Xenopus lævis* to methyl testosterone. Methyl testosterone can induce ovulation in *Xenopus lævis*. The ovulation response of the animals to different doses of this steroid was investigated in July 1937 and in January, April and August 1938. At least forty animals were injected for each dose-level. The dose in γ was plotted against the response per cent.

September 21.

W. G. SHARPLES: A *coup-de-poing* factory site in the Nieuwveld.

RAYMOND A. DART: Population fluctuation over 7,000 years in Egypt.

Moscow

Academy of Sciences (*C.R.*, **19**, No. 8, 1938).

I. D. PAPANIN: Conquest of the Pole.

P. P. SHIRSHOV: Oceanological observations.

E. K. FEDOROV: Geophysical and astronomical observations.

W. N. SHOULEJKIN: The drift of ice-fields.

S. P. KACHURIN: Frozen grounds recede.

N. E. KOTCHIN: Movement of a heavy liquid in a channel with a step on its bottom.

B. G. FESSENKOFF: Astrophysics at the North Pole.

A. A. GRIGOREV: Main physico-geographical features of land in the arctic belt.

A. D. ARKHANGELSKY: Principal features of the tectonics of the northern part of the Atlantic Ocean and the Arctic.

S. L. KUSHEV and J. A. LIVEROVSKY: Principal points in the evolution of the physico-geographical conditions prevailing in the central depression of Kamchatka during the Quaternary.

A. E. FERSMAN: Geochemistry and mineralogy of polar regions.

V. I. VERNADSKY: Some current problems in the study of ice of the arctic regions.

M. V. KLENOVA: Colouring of the Polar Sea sediments.

N. I. TCHIGIRIN: Concentration of calcium carbonate in the waters of the polar basin.

S. W. BRUJEVICZ: Oxidation-reduction and the *p*H of sediments of the Barentz and Kara Seas.

B. G. BOGOROV: Biological seasons of the arctic seas.

P. I. USACHEV: Biological analysis of ice-floes.

A. A. EGOROVA: Thermophile bacteria in the Arctic.

V. S. BUTKEWITCH: Bacteria in the seas of the high-latitude arctic regions.

P. J. SCHMIDT: Three new deep-sea fishes from the Okhotsk Sea.

Forthcoming Events

[*Meetings marked with an asterisk are open to the public.*]

Monday, October 24

UNIVERSITY OF LEEDS, at 5.15.—Prof. H. Dingle: "The Social Relations of Science".*

Tuesday, October 25

ROYAL HORTICULTURAL SOCIETY, at 3.30.—F. J. Chittenden: "The Behaviour of Plants" (Master's Memorial Lectures. Succeeding lecture on November 8).

Wednesday, October 26

IRON AND STEEL INSTITUTE (at the Institution of Civil Engineers), at 10 a.m.—Autumn Meeting.

Thursday, October 27

BIRKBECK COLLEGE, at 5.30.—Prof. R. Blanchard: "Habitat in the Northern French Alps" (succeeding lecture on October 26).*

CHADWICK PUBLIC LECTURE (at the Royal Sanitary Institute), at 5.30.—Norman Macfadyen: "The Evils of the Congestion of Population and the Way Out".*

Friday, October 28

GEOPHYSICAL DISCUSSION (at the Royal Astronomical Society), at 4.30.—"The New Triangulation", to be opened by Major M. Hotine.

BEDSON CLUB, KING'S COLLEGE, NEWCASTLE-UPON-TYNE, at 6.45.—Prof. Max Born: "Statistics in Chemistry and Physics" (Bedson Lecture).

Appointments Vacant

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

LECTURER IN MATHEMATICS AND GEOGRAPHY in the County Training College, Crewe—The Director of Education, County Education Offices, City Road, Chester (October 11).

SCIENTIST FOR WORK IN CONNEXION WITH HYDROGEN PRODUCTION at the Balloon Development Establishment, Cardington—The Under-Secretary for State, Air Ministry (S.2.D.), Adastral House, Kingsway, W.C.2 (ref. B. 135. October 29).

SUPERINTENDENT OF THE ENGINEERING DEPARTMENT of the National Physical Laboratory—The Director, National Physical Laboratory, Teddington, Middlesex (November 7).

LECTURER IN ENGINEERING AND LECTURER IN BUILDING TRADES in East London Technical College, South Africa—High Commissioner for South Africa, Trafalgar Square, London, W.C.2 (November 11).

DEPUTY DIRECTOR of the Imperial Bureau of Animal Nutrition Aberdeen—The Secretary, Imperial Agricultural Bureaux, 2 Queen Anne's Gate Buildings, London, S.W.1 (November 19).

DEPUTY DIRECTOR of the Imperial Bureau of Animal Breeding and Genetics, Edinburgh—Prof. F. A. E. Crew, Institute of Animal Genetics, West Mains Road, Edinburgh (December 1).

ASSISTANT LECTURER IN PSYCHOLOGY in the University of Western Australia—The Secretary to the Agent-General for Western Australia, Savoy House, 115–116, Strand, W.C.2.

Reports and other Publications

(*not included in the monthly Books Supplement*)

Great Britain and Ireland

Department of Scientific and Industrial Research. Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for the Year 1937; with Report of the Geological Survey Board and Report of the Director. Pp. iv+109. (London: H.M. Stationery Office.) 2*s.* net. [510

Transactions of the Royal Society of Edinburgh. Vol. 59, Part 2, No. 14: An Analysis and Comparison of the Structural Features of *Dactylotheca plumosa* Artis sp. and *Senftenbergia ophiodermatica* Göppert sp. By Norman W. Radforth. Pp. 385–396+2 plates. 2*s.* 3*d.* Vol. 59, Part 2, No. 15: On *Rhamphodopsis*, a Ptyctodont from the Middle Old Red Sandstone of Scotland. By Prof. D. M. S. Watson. Pp. 397–410+1 plate. 2*s.* 3*d.* (Edinburgh: Robert Grant and Son, Ltd.; London: Williams and Norgate, Ltd.) [510

Imperial Forestry Institute. Institute Paper No. 14: A World Tour for the Study of Soil Erosion Control Methods. By Dr. A. Grasovsky. Pp. vi+76+5 plates. (Oxford: The University.) 5*s.* [1010

Other Countries

Southern Rhodesia. Meteorological Report for the Year ended 30th June 1937, by the Department of Agriculture. Pp. 90. (Salisbury, S. Rhodesia: Government Stationery Office.) [410

U.S. Department of the Interior: Office of Education. Bulletin, 1937, No. 2: A Survey of a Decennium of Education in Countries other than the United States. (Being Chapter VII of Vol. 1 of the Biennial Survey of Education in the United States, 1934–36.) By James F. Abel. Pp. vii+97. 15 cents. Bulletin, 1937, No. 18: Preparation for Elementary School Supervision. (Project in Research in Universities.) By Mary Dabney Davis. Pp. vi+76. 15 cents. Leaflet No. 30: Federal Aid for Education, 1935–36 and 1936–37; with a Brief History and Bibliography. By Timon Covert. Pp. iii+24. 10 cents. Pamphlet No. 83: Handbook for Compiling Age-Grade-Progress Statistics. By David Segel. Pp. iii+31. 10 cents. (Washington, D.C.: Government Printing Office.) [410

Kungl. Svenska Vetenskapsakademiens Handlingar. Serien 3, Band 16, No. 6: Litorale Amphipoden des tropischen Pazifiks nach Sammlungen von Prof. Bock (Stockholm), Prof. Dahl (Berlin), und Prof. Pietschmann (Wien). Von A. Schellenberg. Pp. 105. Serien 3, Band 16, No. 7: Über die oxydation von Zinkblende-Einkristallen an Hand von elektroneninterferenzen Studiert. Von G. Aminoff und B. Broomé. Pp. 12+2 plates. (Stockholm: Almquist and Wiksells Boktryckeri-A.-B.) [610

U.S. Department of the Interior: Geological Survey. Bulletin 886-C: Geology and Ore Deposits of the Southwestern Arkansas Quicksilver District. By John C. Reed and Francis G. Wells. (Contributions to Economic Geology, 1937.) Pp. vi+17–90+plates 2–17. 75 cents. Bulletin 893: Metalliferous Mineral Deposits of the Cascade Range in Oregon. By Eugene Callaghan and A. F. Buddington. Pp. viii+141+22 plates. 1.25 dollars. Bulletin 900-A: Subsurface Geology and Oil and Gas Resources of Osage County, Oklahoma. Part 1: Townships 22 and 23 North, Ranges 10 and 11 East. By N. W. Bass, L. E. Kennedy, W. R. Dillard, Otto Leatherock and J. H. Hengst. Pp. iv+45+1 plate. 30 cents. Professional Paper 189-A: Species and Genera of Tertiary Noetinæ. By F. Stearns MacNeil. (Shorter Contributions to General Geology, 1937.) Pp. ii+49+6 plates. 20 cents. Professional Paper 189-C: Pliocene Diatoms from the Kettleman Hills, California. By K. E. Lohman. (Shorter Contributions to General Geology, 1937.) Pp. ii+81–102+plates 20–23. 15 cents. Professional Paper 190: Lower Pliocene Mollusks and Echinoids from the Los Angeles Basin, California; and their Inferred Environment. By W. P. Woodring. Pp. ii+37+6 plates. 30 cents. Water-Supply Paper 810: Surface Water Supply of the United States, 1936. Part 10: The Great Basin. Pp. iv+90+1 plate. 20 cents. Water-Supply Paper 820: Drought of 1936, with Discussion on the Significance of Drought in relation to Climate. By John C. Hoyt. Pp. iv+62. 15 cents. (Washington, D.C.: Government Printing Office.) [1010

Smithsonian Institution: United States National Museum. Bulletin 170: Life Histories of North American Birds of Prey. Part 2: Orders Falconiformes and Strigiformes. By Arthur Cleveland Bent. Pp. viii+482+92 plates. (Washington, D.C.: Government Printing Office.) 60 cents. [1010

Annual Report of the Board of Regents of the Smithsonian Institution, showing the Operations, Expenditures and Condition of the Institution for the Year ending June 30, 1937. (Publication 3451.) Pp. xv+580. (Washington, D.C.: Government Printing Office.) 1 dollar. [1010

Smithsonian Institution: Bureau of American Ethnology. Bulletin 118: An Archæological Survey of the Norris Basin in Eastern Tennessee. By William S. Webb. Pp. xv+398+152 plates. (Washington, D.C.: Government Printing Office.) 1 dollar. [1010

U.S. Department of the Interior: Office of Education. Pamphlet No. 84: Safety and Sanitation in Institutions of Higher Education. By Dr. James Frederick Rogers. Pp. v+22. (Washington, D.C.: Government Printing Office.) 10 cents. [1010

League of Nations: Advisory Committee on Social Questions. Enquiry into Measures of Rehabilitation of Prostitutes. Part 1: Prostitutes, their Early Lives. (Official No.: C.218.M.120.1938.IV.) Pp. 140. (Geneva: League of Nations; London: George Allen and Unwin, Ltd.) 3*s.* [1010

Journal of the Faculty of Agriculture, Hokkaido Imperial University. Vol. 43, Part 2: Studies on the Agaricaceæ of Hokkaido, II. By Sanshi Imai. Pp. 179–378. (Tokyo: Maruzen Co., Ltd.) [1010

Indian Forest Records (New Series). Silviculture, Vol. 3, No. 3: An Investigation into the Relative Merits of Planting Teak (*Tectona grandis*) Stumps in Pits and in Crowbar Holes in Areas having a West Coast Type of Climate. By A. L. Griffith. Pp. ii+47–60. (Delhi: Manager of Publications.) 6 annas; 8*d.* [1010

Annales Bryologici: a Year-Book devoted to the Study of Mosses and Hepatics. Edited by Fr. Verdoorn. Vol. 11 (1938): Alexander W. Evans Dedicatory Volume. Pp. vi+160. (Leiden: Chronica Botanica Co.; London: Wm. Dawson and Sons, Ltd.) 6 guilders. [1010

Commonwealth of Australia: Council for Scientific and Industrial Research. Bulletin No. 119: The Wood Structure of some Australian Cunoniaceæ with Methods for their Identification. By H. E. Dadswell and Audrey M. Eckersley. (Division of Forest Products: Technical Paper No. 27.) Pp. 23+7 plates. Pamphlet No. 80: The Storage of Oranges, with Special Reference to Locality, Maturity, Respiration and Chemical Composition. By Dr. S. A. Trout, G. B. Tindale and Dr. F. E. Huelin. Pp. 59. Pamphlet No. 81: The Properties of Australian Timbers. Part 3: *Pinus radiata* D. Don (*Pinus insignis* Doug.) Insignis, Monterey, or Remarkable Pine. A Report prepared by the Division of Forest Products. (Division of Forest Products: Technical Paper No. 28.) Pp. 31. Pamphlet No. 82: The Humidity of the Atmosphere and the Moisture Conditions within Mounds of *Eutermes exitiosus* Hill. By R. V. Fyfe and F. J. Gay. Pp. 22. Pamphlet No. 83: Fleece Investigations. By F. G. Lennox. Pp. 27. (Melbourne: Government Printer.) [1010

Publications of the Dominion Observatory, Ottawa. Vol. 12: Bibliography of Seismology. No. 18: Items 3903–4020; April, May, June, 1938. By Ernest A. Hodgson. Pp. 367–382. (Ottawa: King's Printer.) 25 cents. [1010